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Evaluation of Travel Demand Management Measures to Relieve Congestion

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PREFACE

This report was prepared by COMSIS Corporation and Harold Katz and Associates under contract to the Federal Highway Administration, U.S. Department of Transportation. It is a case study review of current Travel Demand Management programs in the United States, with an emphasis on their capability to reduce traffic. Research for the project was sponsored by the FHWA, and occurred during the period October 1988 through July 1989. Results reported were the most current available through this period.

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EVALUATION OF THE EFFECTIVENESS OF TRAVEL DEMAND MANAGEMENT PROGRAMS

1. BACKGROUND

Travel Demand Management (TDM) has become popular terminology to describe a system of actions whose purpose is to alleviate traffic problems through improved management of vehicle trip demand. These actions, which are primarily directed at commuter travel, are structured to either reduce the dependence on and use of single-occupant vehicles, or to alter the timing of travel to other, less congested time periods. Simply stated, the purpose of Travel Demand Management is to maximize the movement of "people," not vehicles, within the transportation system.

Travel Demand Management is a *process*. It is both the transportation actions which affect the travel time, cost and other considerations that shape travel behavior, as well as a specialized way of implementing these actions, through often innovative legal and institutional approaches.

Most of the actions considered to be in the realm of TDM are not new. They may be described according to the following types of strategies:

- **Improved Alternatives** -- TDM offers travelers legitimate alternatives to driving alone. Alternatives include various types of transit service, carpooling and vanpooling, and where appropriate, provisions for walking and bicycling. The emphasis, however, is on providing these alternatives in a manner which makes them competitive with the service levels offered by the private auto.

- **Incentives and Disincentives** -- While opportunities exist to design more competitive alternatives, even the best designs will have difficulty achieving an equal level of competition with the auto, particularly in the suburban environment where employment destinations are widely scattered and parking on-site is generally provided free by the employer. Incentives are necessary to overcome these built-in advantages and equalize the economic competition between auto and the other modes. These incentives can include travel time savings, such as are afforded by High Occupancy Vehicle (HOV) lanes, priority treatment at ramps and entranceways, and preferential parking at the destination. Financial incentives are also important, and can consist of direct subsidies to non-Single Occupancy Vehicle (SOV) users, in-kind subsidies such as discounted transit fares, or "inverted" parking rates which favor HOVs.

- **Work Hours Management** -- The first two types of TDM actions directly affect travel efficiency in terms of choice of mode. Work hours management strategies try to affect vehicle trip demand on highway facilities by shifting that demand to less congested time periods. This includes such strategies as flexible work hours (flextime), staggered work hours, and modified work schedules (4-day work week, work at home options).

Many of these TDM actions were once referred to as Transportation System Management, or "TSM" strategies, and had the same overall objective of trying to "stretch" the capacity of the existing transportation system, and avoid expensive new construction. What distinguishes TDM from TSM is its emphasis on shaping travel demand, as opposed to effecting improvements to the transportation system itself. What is also different is the way that these actions are applied, and the responsibility for their application. The responsibility in TDM programs is shared by both public and private sectors. This is of great importance, because with the participation and support of developers and employers, important incentives which affect individual travel decisions may be controlled at the source.

2. PURPOSE OF REPORT

This report summarizes the results of a research study, sponsored by the Federal Highway Administration, to investigate the effectiveness of existing Travel Demand Management programs. This investigation consisted of the evaluation of a number of existing TDM programs located within the United States. The programs, many of which are well known, are varied in size, setting, motivation and accomplishments. Together, they comprise a fairly representative cross section of contemporary experience with TDM.

The purpose of this study has been to measure directly the quantitative impact of these varied TDM approaches on reducing low-occupancy vehicle trips. Much of was is known and has been reported on TDM has dealt with the legal, institutional and organizational aspects of these programs. While implementation of TDM actions is highly dependent upon such background factors, it has left largely unanswered the basic question: "Is TDM effective in reducing low-occupancy vehicle trips?" The answer to this question will ultimately determine whether TDM will capture the legal and institutional support it needs to be effective in solving highway capacity problems.

While traffic congestion has long been a concern in urban areas, megatrends in the suburbanization of employment are now resulting in some of the country's worst traffic problems occurring in the suburbs. These areas are ill-equipped to cope with large -scale traffic problems. In many cases, residential and commercial development has proceeded far ahead of construction of the necessary infrastructure to accommodate the related traffic. Often, this delay has meant that key segments of the highway system have not been, and now may never be, constructed. Growth projections strongly suggest an ever-widening gap between the demand for travel and physical capacity. In other words, today's traffic problems figure to get much worse.

Attempting to build adequate new highway capacity to satisfy this demand is frustrated by several problems:

- o Limited funds to finance the enormous costs of constructing new highways;
- o Physical space constraints in finding appropriate rights of way for new or expanded highways, matched by citizen resistance to new highways in existing communities;
- o A high rate of growth in vehicle travel relative to increases in person travel, reflecting a continuing decline in the efficiency with which highways are used.

Is TDM a strategy in which confidence can be placed to help deal with this ever-widening gap and the resultant traffic congestion? How much traffic can be reduced by TDM? How can this reduction be measured and validated? What factors contribute to the trip reduction accomplishments of a TDM program? These are all questions which the subject research was designed to address.

3. CASE STUDY FRAMEWORK

The study was structured around a sampling of existing TDM programs. The approach was to evaluate each program as a separate case study, using the same set of evaluation tools and guidelines for each. The report which follows this introduction presents these individual case studies, detailing for each:

- o The setting of the program;
- o The background and motivation for the TDM program;
- o The technical and administrative elements of the TDM program;
- o An estimate of the program's trip reduction impacts.

TDM is normally directed at commute travel, though it need not be restricted to just this market segment. There are several reasons for the focus on commuters. First, the most significant demand placed on the transportation system usually occurs during weekday peak periods. This time period is dominated by commuter travel, which is characterized by the lowest vehicle occupancy rates of all travel purposes. Second, the day-to-day regularity of commuter trips and the comparatively high travel densities make this travel market the most suitable for finding alternatives. Third, conditions at the workplace, in terms of employer practices (such as free parking), are important targets for modification with TDM actions. Therefore, most current TDM programs deal with commuters, and that is reflected in the case studies selected for this report.

Except for a small number of cases, each of the case studies reports on an "areawide" (subarea or corridor level) TDM effort. In other words, traffic conditions have created sufficient concern that there is a collective effort within the community to take action against it. In some instances, the initiative has been provoked by a legal action, such as an

ordinance; in others, it has occurred out of direct self interest of the business community. Where possible with available data, an assessment has been made of the trip reduction impact of this "collective" areawide effort.

Within each areawide program, however, are TDM programs run by individual employers. Typically the number of outstanding individual programs dictates the level of achievement of the areawide effort. Much can be learned from these individual "success stories", because generally the specific TDM elements can be isolated and the data for measuring impacts is more precise. Therefore, each case study includes at least one individual employer example, whose results rank above the average for the areawide effort.

Listed in Table 1 are the various TDM programs selected for evaluation by the study. Each of the major programs is listed in the first column, and described in the second column as to the primary type of setting that it represents:

- Regional CBD
- Corridor
- Suburban Activity Center
- Suburban Business Park

The study has produced TDM trip reduction estimates for each of the programs listed in the first column. Then, within each of these overall programs exist generally one or more individual employer programs which has been documented and evaluated. These are listed in the third column of Table 1.

4. MEASUREMENT TECHNIQUE

The goal of this study was to determine whether particular TDM efforts have had a measurable impact on traffic volumes. Several approaches were considered to accomplish this measurement.

The desired approach was to measure changes in traffic volumes themselves. After considerable thought, this approach was deemed infeasible, for several reasons:

- Lack of available data -- no situations were encountered where traffic counts were available for comparable measurement locations before and after the introduction of a TDM program.

TABLE 1

LISTING AND CATEGORIZATION: TDM PROGRAM SITES

Overall Program	Setting	Individual Employer Sites
Downtown Hartford, Connecticut Transportation Management Program	Regional CBD	Travelers Insurance Hartford Steam Boiler
North Bethesda Montgomery County, Maryland	Suburban Activity Center	Nuclear Regulatory Commission
The 3M Company St. Paul, Minnesota	Suburban Business Park	3M Company
Minnesota Rideshare Downtown Free Parking Program Minneapolis, Minnesota	Regional CBD	
I-394 Interim HOV Lane Minneapolis, Minnesota	Radial Corridor	
Downtown Bellevue TDM Program Bellevue, Washington	Suburban Activity Center	US WEST CH_2M Hill
Bishop Ranch Business Park Contra Costa County, California	Suburban Business Park	AT&T
UCLA/Westwood Los Angeles, California	Suburban Activity Center	University of Calif., at Los Angeles
Downtown Los Angeles	Regional CBD	Atlantic-Richfield Bank of America L.A. Dept. of Water and Power
South Coast Metro Orange County, California	Suburban Activity Center	State Farm

- Intervening Factors -- even if comparable volume data could be found, there was great difficulty separating the effects of external factors on the measured volumes, such as net areawide population/employment growth/decline, or changes in the transportation system.

- High Variability -- high day-to-day or seasonal variability in traffic counts further reduces their usefulness for making valid determination of relatively small changes.

A secondary measure which is frequently used to assess traffic impacts is average vehicle occupancy. Higher levels of average vehicle occupancy are equated with higher levels of efficiency, which may be translated to reduced vehicular demand for highway capacity. This measure was considered but also deemed infeasible because:

- Data Availability -- few if any programs had estimates of vehicle occupancy from comparable sources before and after TDM program introduction.

- Measurement Error -- at least two types of measurement problems limit reliance on vehicle occupancy as a primary indicator: (1) the measure usually does not account for

usage of public transit, walking or bicycle, which makes it misleading as an efficiency measure for some sites; and (2) it becomes difficult to *physically* measure vehicle occupancy at work site locations where there are multiple employers, parking locations or entry points.

Ultimately, the type of data available was used to shape the measure. The most universally available information from TDM programs was employee modal split, measured through employee surveys. Clearly, measures derived from surveys raise the question about response bias from small samples. This potential for response bias cannot be denied, but has been minimized by (1) using information from surveys where the rate of response was at least 35%, and (2) comparing survey results developed from a comparable procedure applied at different points in time.

To estimate vehicle trip reduction impact from modal split, a special index was developed: **Number of Vehicle Trips per 100 Travelers.** This index represents the rate at which vehicle trips are generated by a particular travel population. The population can be the employees in a business park or the total travelers in a corridor or activity center.

The index estimates vehicle trip generation from modal split by assuming the following occupancy levels for each mode:

- Drive Alone -- 1 vehicle trip for every person trip

- Carpool -- 0.4 vehicle trips for every person trip (assumes 2.5 persons per carpool)

- Vanpool -- 0.083 vehicle trips for every person trip (assumes 12 persons per vanpool)

- Transit -- 0.033 vehicle trips for every person trip (assumes 30 persons per vehicle)

- Bicycle/Walking -- no vehicle trips per person trip.

The vehicle occupancy assumptions are made in order to place each of the sites on an equivalent basis. In many cases, the modal split information is known, but the actual vehicle occupancy rates for the various modes is not. The occupancy assumptions were adopted from the work of Bay Area RIDES in San Francisco, which uses this estimating basis to determine compliance with regional trip reduction ordinances.

Understanding the index is quite simple. A reading of 100 vehicle trips per 100 travelers indicates that everyone in the travel base is driving alone. As the index declines, it is an indication of increased efficiency through the use of high occupancy vehicle modes, and in particular, signifies ***vehicle trips not taken*** to support the same level of person movement.

To determine the number of vehicle trips reduced by a TDM program, the TDM program must be compared with a reference base or "control site" that does not include TDM. This comparison is necessary because it is invalid to assume that the starting point for a TDM program is the situation where everyone drives alone. Selection of this reference base is important. The following are candidate bases, in declining order of preference:

1) The organization or area itself before the TDM program.

2) A comparable organization or area that does not have TDM.

3) The behavior of the surrounding region.

Using the trip generation index, the study estimates the number of vehicle trips that are made by the TDM population under the TDM program, and then determines the number of vehicle trips that would have been made in the absence of TDM, as represented by the trip generation index value for the control base. The difference in the number of vehicle trips that would be made by the same population, assuming the different rates of trip generation, is defined as the **net trip reduction** accomplished by the TDM program. These are vehicle trips that would otherwise exert a demand on the highway system if they had not been eliminated through TDM.

This measurement technique offers satisfactory results for programs which have accomplished their effect through changing traveler mode choice. A somewhat different situation is posed by work hours management strategies. With work hours management, the objective is not to reduce vehicle travel, *per se*, but to shift its timing to periods of lower demand.

In principal, measurement of the trip reduction effect of work hours strategies would be similar to mode shifts. A measurement index which measures **peak hour vehicle trip generation** would be a comparable statistic to the former index. The difficulty in performing an assessment of variable work hours trip reduction, however, is in finding suitable control sites for use in gauging net impact. Trip time distribution information is much less frequently obtained than modal split. Therefore, it is difficult to gain a clear measure of reduction for this strategy from existing data.

5. DESCRIPTION OF CASE STUDIES

This section offers brief descriptions of each of the TDM programs which were selected for inclusion as case study examples. The summaries describe the background and setting for each of the examples, identify the principal role players, and list the major elements of the TDM program. Trip reduction impacts are discussed in a later section.

Downtown Hartford, Connecticut Transportation Management Program

The business community in downtown Hartford sensed growing problems with traffic back in the early 1980's, triggered by a development boom in the downtown, and the knowledge that there were no plans to add to the City's limited highway infrastructure. A comprehensive public-private transportation management program was initiated which involved 11 of the largest downtown employers, accounting for about 40% of the approximately 100,000 employees. Most of these employers are insurance companies, which are also land owners with a major stake in the continued viability of the downtown. While parking is restricted in the downtown, many employers compete for employees with parking benefits, which has proved to be a major factor influencing travel patterns. The public-private management organization has attempted to work both with employers to eliminate practices which encourage driving, as well as with the public sector to provide improved transit and other service options for commuters. Two firms, Travelers Insurance and Hartford Steam Boiler, have initiated their own comprehensive TDM programs which have achieved impressive trip reductions.

Nuclear Regulatory Commission, Montgomery County, Maryland

Montgomery County, Maryland, a suburb of Washington, D.C., maintains a program of active measures to control development and traffic in a high-growth environment. Central to this system of controls is the Adequate Public Facilities Ordinance, which restricts new development to the capacity of the transportation system to provide an adequate level of service. Level of service standards have been established for each of 15 planning areas, and development applications are staged to the capacity of the transportation system in the respective subarea. A Transportation Management Association has been formulated in the North Bethesda planning area to search out solutions to a current development moratorium. While the TMA is only in its early stages, there is one individual example, the Nuclear Regulatory Commission (NRC), that serves as an important case study. When planning its relocation of 2,450 employees to a central headquarters in North Bethesda, the Nuclear Regulatory Commission encountered difficulty when it was realized that the full consolidation of its staff would generate a level of vehicle trips that would exceed the limits established by the county ordinance. In order to accomplish its consolidation, the NRC developed a comprehensive TDM plan for its employees including improved alternatives, subsidies and parking management strategies. The trip reduction achieved at the first building so successful that the county granted the NRC permission to proceed with construction on the second building, which will allow NRC to complete its consolidation.

3M Company TDM Program, St. Paul, Minnesota

3M is a major technology/light manufacturing firm located in the suburbs east of St. Paul. About 12,700 employees are employed at the company's 3M Center complex. 3M's pursuit of a TDM program was motivated entirely by internal objectives. Poor access to the site and competing demand for land between parking lots and buildings caused the company to become involved in transportation management back in the early 1970's. Since that time, the company has launched both work hours management programs and development of alternate travel modes. 3M has designed and managed significant subscription bus, carpool and vanpool programs. Its vanpool program has been one of the country's model programs for many years.

I-394 Interim HOV lane, Minneapolis, Minnesota

When Trunk Highway 12 into downtown Minneapolis was scheduled for reconstruction as Interstate 394, one of the conditions placed on the new facility was that it include High Occupancy Vehicle (HOV) lanes. To ease traffic problems during construction and begin to shape behavior toward the eventual opening of the lane, an interim HOV lane was installed on Highway 12 beginning in 1985. Known as the "Sane Lane", the single reversible lane gained significant favor from corridor travelers, and has been credited with both converting a high percentage of drivers over to carpooling, as well as attracting travelers from parallel routes. This case study is of a different character than most of the others, in that it features the application of a single TDM strategy, i.e., an HOV lane, by a public agency in a very specific setting, an urban corridor. Its importance is that it demonstrates the impact of this key TDM strategy on shaping travel behavior.

Downtown Free Parking Program, Minneapolis, Minnesota

Concurrent with the I-394 Interim HOV lane, the Minnesota Department of Transportation, through its Minnesota Rideshare office, devised and implemented a free parking program in downtown Minneapolis. The program makes available free parking at a series of CBD fringe lots to registered pool units of 2 or more travelers. The program conveys savings of $30 to $80 per month to users over parking costs in comparable location. While the program was designed to complement the I-394 program, it is available to and used by all carpoolers to downtown Minneapolis. Like the I-394 case study, the Free Parking Program is a particular example of a single, targeted TDM strategy -- free parking to carpools -- implemented by a public agency.

Downtown Bellevue, Washington TDM Program

Downtown Bellevue, Washington is a suburban center with an employment of about 24,000. The CBD is somewhat atypical of suburban activity centers with its preponderance of high rise buildings, grid-like streets and sidewalks, and restricted parking. These characteristics were influenced by City officials. While there is no formal TDM ordinance in downtown Bellevue, developers are required to minimize building setbacks, restrict parking to a maximum of 2.4 spaces per 1000 square feet, and employ measures to offer employees alternative commuting options to minimize parking spillover to other facilities. A Transportation Management Association (TMA) has been formulated to help businesses

cope with the restrictions and find alternatives for their employees. The city and the TMA have also worked to develop transit and system design elements to encourage use of HOV modes. The Bellevue CBD program has demonstrated significant overall trip reduction relative to regional standards, and there are several individual programs, particularly those of US WEST and CH_2M Hill, which have achieved exemplary trip reductions.

Bishop Ranch Business Park, Contra Costa County, California

Bishop Ranch is a modern business park located at the eastern fringe of the San Francisco metropolitan area, near the town of San Ramon, in Contra Costa County. Bishop Ranch is about 35 miles from San Francisco, and the area in which it is located is of extremely low density. It has become the home of several major organizations with significant employment space requirements, such as Pacific Bell and Chevron, which were formerly located in San Francisco. The park has been in existence since the early 1980s, and its employment, which is predominately white collar professional, numbers 14,000. Bishop Ranch's two primary developers were placed under a requirement by Contra Costa County to reduce their peak hour vehicle trips by 40%. They have satisfied this requirement through a combination of alternative modes and flexible work hours, with a significant role played by flextime. Helping the large number of employees in the relocation to the new office space was an important factor influencing early success of the program. A TMA has been formed in Bishop Ranch to assist with the transportation management program. The TDM program of Pacific Bell is an exemplary individual effort.

City of Pleasanton & Hacienda Business Park, Alameda County, California

Hacienda Business Park is a very similar situation to Bishop Ranch. It is located just south of Bishop Ranch, along I-680 in Alameda County. Hacienda is located near the town of Pleasanton, which effected a TDM ordinance in conjunction with the planning of Hacienda, to limit the traffic impacts of the new development. The ordinance requires a 40% reduction in peak period vehicle trips for all large employers, and it applies to the entire city of Pleasanton as well as Hacienda. The employment at Hacienda is just under 8,000, and the City of Pleasanton, including Hacienda, has an employment of about 22,000. Hacienda has achieved its reduction goal through a combination of alternate mode programs and flexible work hours, with most of the reductions achieved through time shifting. Again, relocation assistance was important to the success the TDM program. Within Hacienda Business Park, the program of AT&T serves as another exemplary individual effort.

University of California at Los Angeles (UCLA)/Westwood Transportation Management Program in Los Angeles

UCLA is located in the Westwood area of Los Angeles. Some 34,000 students attend UCLA, and over 18,000 people work on campus. Westwood is a diversified major activity center, with restaurants, retail and office activity, plus an affluent residential community of about 37,000. Traffic in Westwood is extremely congested, and the community has maintained pressure on the University to manage the traffic generated by its student and employee population. The University has developed a comprehensive management program which includes strategic use of its parking facilities, express and shuttle bus

services, a carpool program and an extensive vanpool program.

Atlantic Richfield Company and Downtown Los Angeles

Downtown Los Angeles, as is all of the L.A. basin, is subject tot the requirements of Regulation XV. This regulation, promulgated by the Air Quality Management District, requires formal trip reduction efforts by all major employers as a means to achieving air quality objectives. Terms of the regulation require evidence of employee commute management programs that will produce near-term achievement of a minimum average vehicle occupancy. One firm which has served as an example for travel management from the time prior to the passage of Regulation XV is Atlantic-Richfield (ARCO). ARCO has a longstanding reputation for aggressive, high impact transportation management programs. The firm's offices in downtown Los Angeles employ about 1500 people. Since relocating to Los Angeles from New York City in 1972, the company has sponsored active carpooling, vanpooling and subscription bus programs for its employees. A large measure of the success of ARCO's program is attributable to the strategic pricing and availability of its employee parking. While it subsidizes employee's parking costs, parking is scaled to the number of vehicle occupants, and the company also offers a Transportation Allowance to employees which further encourages high occupancy vehicle travel. Several other programs in downtown Los Angeles with above-average results are also featured in this case study.

South Coast Metro, Orange County, California

Orange County, located south of Los Angeles, is one of the fastest growing counties in the nation, and features a number of employment centers of major size and regional significance. The spread-out nature of this suburban county has meant an unusually rapid growth of traffic problems. As with the rest of the Los Angeles region, air quality concerns are forcing trip reduction responsibilities on all major employers under Regulation XV. One of the major employment centers addressing itself to this new regulation is South Coast Metro, a 2200-acre mixed-use activity center situated between the cities of Costa Mesa and Santa Ana. At build out, South Coast Metro is expected to contain 13.5 million square feet of office space and employ 45,000 people. Current employment is about 25,000, with over 1100 firms. The transportation management program at South Coast Metro was initiated before the enactment of Regulation XV, but clearly the effectiveness of the program is being greatly influenced by the regional mandate. While initiatives inspired by Regulation XV are still too early to allow measurable trip reduction impacts in the area as a whole, some of the individual employers have interesting programs which are underway and have already achieved impressive results. One of these is State Farm, which improved its vehicle occupancy from 1.21 to 1.55 in a little over one month through a creative carpool subsidy program.

6. REVIEW OF RESULTS

Structure and Content of Summary Tables

Tables 2A through 2H provide a summary level review of the findings from the case study evaluations. Each table presents findings from a particular geographic area. Within each area, the table first reports on the areawide program, if such a program exists. Following the areawide summary are results on any individual projects within the areawide effort that have meaningful impacts.

Each table is comprised of several entries. The feature entries are the TDM examples themselves. The second column of the table indicates whether the example is a **TDM** case or one of the **Control** cases; the controls are used as the base of comparison against which TDM trip reduction is measured.

Each entry in the table is described by several characteristics which define travel conditions at the site. These characteristics include:

o The **Travel Base** to which the TDM measures apply (shown only for TDM examples, for reasons of relevance);

o The **Drive Alone Rate** (current percentage of all travelers who drive alone);

o The **Average Vehicle Occupancy** rate (calculated using same modal occupancy assumptions used in vehicle trip index);

o The vehicle trip generation rate, expressed as **Number of Vehicle Trips per 100 Travelers.** This rate is calculated from modal split information, assuming 2.5 persons per carpool, 12 persons per vanpool, and 30 persons per transit trip.

o The **Total Vehicle Trips** (daily one-way) generated by the travel base, using the Vehicle Trip per 100 Travelers index.

The calculated **Trip Reduction** is then shown in boldface below the respective entry. The calculation of vehicle trip reduction is made by comparing the TDM example with one or more relevant control examples. To calculate the reduction, the number of vehicle trips for the TDM site is first calculated using the Trips per 100 index achieved by the site, and then calculated assuming the travel base were to travel at the rate exhibited by the control, using the control's index. The difference in vehicle trips from these two calculations is the **Net Trip Reduction** credited to the project. It is presented in the table as both a **Total Trip Reduction** and a **Percentage Reduction.**

Sample Table

Table 2-A, which summarizes the results for Hartford, is used as an example to illustrate how the tables are interpreted. The first entry (1) in the table describes the travel conditions measured in downtown Hartford in 1987, following implementation of its

areawide TDM program. The Travel Base to which the TDM program has been applied is 102,000 downtown employees. Characteristics of this travel population after implementation of the TDM program include a Drive Alone Rate of 45%, an Average Vehicle Occupancy of 1.79, and a vehicle trip generation rate of 56.0 Vehicle Trips per 100 travelers. Applying this rate to the travel base yields an estimated 57,120 daily one-way vehicle trips generated by this population.

Clearly, these would be enviable travel statistics in most travel markets, particularly the suburbs, where drive alone rates are closer to 90% and vehicle occupancy rates are only slightly above 1.0. But Hartford was already starting from a significant base, as shown in the control case (2), which is Hartford in 1981 before the TDM program. Even in 1981, the drive alone rate was only 48%, and average vehicle occupancy was 1.74. Comparing the pre and post-TDM situations (1) vs. (2) implies that the TDM program accomplished only a 2.4% reduction in vehicle tripmaking, or 1428 daily one-way vehicle trips. There are important reasons why Hartford's areawide TDM program accomplished only a modest trip reduction, and these are discussed in the case study. But for the purpose of understanding Table 2-A, the Trip Reduction is calculated by assuming that if the 1987 TDM travel population of 102,000 employees were to travel at the vehicle trip generation rate observed in 1981, or 57.4 trips per 100, they would generate 58,548 vehicle trips, vs. the 57,120 generated at the 56.0 per 100 rate observed after the TDM program in 1987. This results in the net reduction of 1,428 trips or 2.4% relative to 1981 levels.

The Hartford TDM program is an "areawide" transportation management effort intended to apply actions across and elicit travel changes from the employment base of a major downtown. All major employers are targeted in this areawide effort, the results of which were described in the comparison above. Within this areawide base are the efforts of numerous individual employers, some of which have achieved outstanding results. Two of these are listed in Table 2-A. They are Travelers Insurance, which is entry (3), and Hartford Steam Boiler, which is entry (5). In the table, each is compared to two standards. Each is first compared to another company within Hartford that is of comparable size and function, but which does not have an active TDM program. For reasons of confidentiality, these comparison companies are referred to as Company "B" and "D", shown as entries (4) and (6), respectively. Comparing Travelers to its non-TDM equal suggests a trip reduction of 47.9%. Comparing Hartford Steam to its equivalent suggests a trip reduction of 26.5%. Both individual TDM programs are also compared to the downtown as a whole before the TDM program (2). This comparison yields a more modest trip reduction of 25.4% and 13.6%, respectively, which would be expected considering that the TDM firms and the non-TDM firms represent the extremes in the downtown, whereas the downtown as a whole represents the average condition.

The other tables are read in virtually the same fashion. The major exceptions to this standard format are Tables 2-C and 2-E. Table 2-C lists three unrelated and somewhat specialized examples from the Twin Cities area, and Table 2-E similarly lists two unrelated examples from the Los Angeles area. All other tables follow the format of Hartford, with an areawide program presented first, followed by one or more individual examples from within the larger program.

TABLE 2-A: SUMMARY OF EFFECTS OF TDM PROGRAMS
Hartford, Connecticut

Location/ Project	Type Site	Travel Base	Drive Alone Rate	Average Vehicle Occupancy	Veh. Trips Per 100 Travelers	Total Vehicle Trips	Vehicle Trip Reduction	Percent Reduction
(1) Downtown Hartford, Post-TDM (1987)	TDM	102,000	45.0%	1.79	56.0	57,120		
(2) Downtown Hartford, Pre-TDM (1981)	Control		48.0%	1.74	57.4			
Trip Reduction, (1) vs. (2)							**1,428**	**2.4%**
(3) Traveler's Insurance	TDM	10,000	33.2%	2.34	42.8	4,280		
(4) Company "B"	Control	9,000	77.6%	1.22	82.1			
Trip Reduction, (3) vs. (4)							**3,930**	**47.9%**
Trip Reduction, (3) vs. (2)							**1,460**	**25.4%**
(5) Hartford Steam Boiler	TDM	1,100	39.9%	2.02	49.6	546		
(6) Company "D"	Control	900	63.0%	1.48	67.5			
Trip Reduction, (5) vs. (6)							**197**	**26.5%**
Trip Reduction, (5) vs. (2)							**86**	**13.6%**

TABLE 2-B: SUMMARY OF EFFECTS OF TDM PROGRAMS
North Bethesda/Montgomery County, Maryland

Location/ Project	Type Site	Travel Base	Drive Alone Rate	Average Vehicle Occupancy	Veh. Trips Per 100 Travelers	Total Vehicle Trips	Vehicle Trip Reduction	Percent Reduction
(1) North Bethesda	Control		89.5%	1.04	91.9			
(2) Nuclear Regulatory Commission, After Consolidation	TDM	1,400	42%	1.59	53.7	752		
Trip Reduction, (2) vs. (1)							**582**	**41.6%**
(3) Nuclear Regulatory Commission, Before Consolidation			54%	1.47	64.4			
Trip Reduction, (2) vs. (3)							**232**	**16.6%**

TABLE 2-C: SUMMARY OF EFFECTS OF TDM PROGRAMS
Minneapolis/St. Paul, Minnesota

Location/ Project	Type Site	Travel Base	Drive Alone Rate	Average Vehicle Occupancy	Veh. Trips Per 100 Travelers	Total Vehicle Trips	Vehicle Trip Reduction	Percent Reduction
(1) Free Parking Program, "Before"	Control	2,752	35.6%	2.05	48.5	1,336		
(2) Free Parking Program, "After"	TDM	2,752	0.0%	2.43	41.2	1,133		
Trip Reduction, (2) vs. (1)							**203**	**15.0%**
(3) I-394 HOV Lane, "Before"	Control	2,680	61.9%	1.17	72.6	1,946		
(4) I-394 HOV Lane, "After"	TDM	3,630	48.7%	1.29	65.8	2,387		
Trip Reduction, (4) vs. (3)							**247**	**10.3%**
(5) 3M Company, Before TDM (1970)	Control	7,723	91.6%	1.09	91.6			
(6) 3M Company, After TDM (1985)	TDM	12,700	82.7%	1.21	82.7	10,503		
Trip Reduction, (6) vs. (5)							**1124**	**9.7%**

TABLE 2-D: SUMMARY OF EFFECTS OF TDM PROGRAMS
Bellevue, Washington

Location/ Project	Type Site	Travel Base	Drive Alone Rate	Average Vehicle Occupancy	Veh. Trips Per 100 Travelers	Total Vehicle Trips	Vehicle Trip Reduction	Percent Reduction
(1) Bellevue CBD, 1988	TDM	24,000	63.2%	1.32	71.0	17,040		
(2) Regional Control Sites, 1988	Control		81.8%	1.12	86.4			
Trip Reduction, (1) vs. (2)							**3,696**	**17.8%**
(3) US WEST	TDM	1,150	25.7%	2.17	45.2	520		
Trip Reduction, (3) vs. (2)							**474**	**47.6%**
(4) Bellevue CBD, less US WEST	Control		79.6%	1.19	83.1			
Trip Reduction, (3) vs. (4)							**436**	**47.1%**
(5) CH_2M Hill, Before Relocation	Control	400	89%	1.07	92.6	370		
(6) CH_2M Hill, After Relocation	TDM	400	54%	1.40	59.4	237		
Trip Reduction, (6) vs. (5)							**133**	**35.7%**
Trip Reduction, (6) vs. (2)							**108**	**31.2%**

TABLE 2-E: SUMMARY OF EFFECTS OF TDM PROGRAMS
Bishop Ranch/Contra Costa County, California

Location/ Project	Type Site	Travel Base	Drive Alone Rate	Average Vehicle Occupancy	Veh. Trips Per 100 Travelers	Total Vehicle Trips	Vehicle Trip Reduction	Percent Reduction
(1) Bishop Ranch Business Park	TDM	14,000	70.2%	1.27	77.6	10,864		
(2) Regional Control Sites	Control		90.6	1.07	93.0			
Trip Reduction, (1) vs. (2)							**2,156**	**16.6%**
(3) Pacific Bell, Bishop Ranch	TDM	6,900	63%	1.35	72.8	5,023		
Trip Reduction, (3) vs. (2)							**1,394**	**27.8%**
(4) Company "B", Bishop Ranch	Control	2,400	73%	1.24	79.1			
Trip Reduction, (3) vs. (4)							**435**	**8.7%**
(5) Bishop Ranch, Less Pac Bell	Control		80%	1.16	85.2			
Trip Reduction, (3) vs. (5)							**856**	**17.0%**

TABLE 2-F: SUMMARY OF EFFECTS OF TDM PROGRAMS
Hacienda Business Park/Pleasanton, California

Location/ Project	Type Site	Travel Base	Drive Alone Rate	Average Vehicle Occupancy	Veh. Trips Per 100 Travelers	Total Vehicle Trips	Vehicle Trip Reduction	Percent Reduction
(1) City of Pleasanton After TDM (1988)	TDM	22,000	84.3%	1.13	88.7	19,521		
(2) Regional Control Sites	Control		90.6%	1.07	93.0			
Trip Reduction, (2) vs. (1)							**946**	**4.8%**
(3) Hacienda Business Park, After TDM	TDM	7,769	78.7%	1.17	85.2	6,623		
Trip Reduction, (3) vs. (2)							**605**	**9.1%**
(4) AT&T, Hacienda Business Park	TDM	3,890	71.3%	1.24	80.5	3,131		
(5) Company "B", Hacienda Business Park	Control		77.2%	1.17	85.2			
Trip Reduction, (4) vs. (2)							**486**	**13.4%**
Trip Reduction, (4) vs. (5)							**183**	**5.5%**

TABLE 2-G: SUMMARY OF EFFECTS OF TDM PROGRAMS
Los Angeles, California

Location/ Project	Type Site	Travel Base	Drive Alone Rate	Average Vehicle Occupancy	Veh. Trips Per 100 Travelers	Total Vehicle Trips	Vehicle Trip Reduction	Percent Reduction
(1) Region, 1988	Control		83%	1.19	83.6			
(2) U.C.L.A.	TDM	18,000	74.4%	1.26	79.0	14,220		
Trip Reduction, (2) vs. (1)							**828**	**5.5%**
(3) ARCO	TDM	2,000	45.3%	1.81	55.3	1,105		
(4) Downtown L.A. Office Workers	Control		60%	1.46	68.3			
Trip Reduction, (3) vs. (4)							**261**	**19.1%**

TABLE 2-H: SUMMARY OF EFFECTS OF TDM PROGRAMS
South Coast Metro/Orange County, California

Location/ Project	Type Site	Travel Base	Drive Alone Rate	Average Vehicle Occupancy	Veh. Trips Per 100 Travelers	Total Vehicle Trips	Vehicle Trip Reduction	Percent Reduction
Orange County, CA								
(1) Countywide Average	Control		90%	1.08	92.4			
(2) South Coast Metro	TDM	25,000	89%	1.08	92.3	23,079		
Trip Reduction, (2) vs. (1)							**none**	**none**
(3) State Farm, South Coast Metro	TDM	980	68%	1.55	64.3	630		
Trip Reduction, (3) vs. (1) or (2)							**276**	**30.4%**

Accomplishments of Subject Programs

The research findings require some interpretation to understand the accomplishments and potential of TDM. Attention is first given to the "areawide" programs.

The areawide approach to TDM is where the measured effects are currently the most modest, but where the greatest potential lies. TDM should be implemented at an areawide level to be most effective. Areawide management programs attempt to encircle the principal functions which contribute to the traffic problem, and to engineer collective action through cooperation of the various stakeholders. This collective action should yield a higher payoff than isolated individual actions.

However, to date, most of the collective, areawide programs have not achieved their potential. In most instances, they have fallen short because major players have not been incorporated into the process, or if they have, their participation is not of the necessary type or level. Listed in Table 3 are the programs which have areawide elements, along with their trip reduction results and other characteristics.

Note from the start that the Minneapolis Free Parking Program and the I-394 HOV Lane are not typical areawide programs. They are examples of single TDM actions applied through the actions of a public agency. They are listed in this table because they are directed to areawide travel markets (Regional CBD and Radial Corridor, respectively) and produce areawide (rather than site specific) impacts.

The other programs are much more typical areawide TDM programs, where a management group has been formulated with significant private sector membership and direction. Table 3 indicates a range of trip reduction achievements from these efforts between 17.8% and 2.4%. What accounts for the difference?

The best areawide efforts were Downtown Bellevue and Bishop Ranch, which achieved 17.8% and 16.6% reductions, respectively. Both are suburban sites, with comparatively limited options to driving. However, in both instances, there are compelling legal reasons for the private sector to become involved. At Bishop Ranch, a county-imposed trip reduction ordinance requires major employers to reduce their peak hour vehicle trip generation by 40%. In the case of Bellevue, the City does not have a trip reduction ordinance, but it imposes development standards on new construction which reduce building setbacks and constrain on-site parking to a maximum of 2.4 spaces per 1000 square feet. In both cases, employers have been inspired to find innovative ways for their employees to reach work without driving alone.

A similar situation to Bishop Ranch exists at Hacienda Business Park, but the response of employers has been somewhat different. Hacienda also must achieve a 40% peak hour vehicle trip reduction, which they have done largely through the use of flexible work hours. Their program has achieved a respectable 9.1%, but the employer programs have been more a response to meeting the requirements of the ordinance, than developing programs which create the best possible options for employees.

The programs in South Coast Metro and North Bethesda are both conceived under rather substantial traffic management ordinances -- South Coast Metro under Regulation XV and North Bethesda under Montgomery County's Adequate Public Facilities Ordinance. In the case of South Coast Metro, it is simply too early to tell if the legal pressure will cause proper participation. The Air Quality Management District, which administers Regulation XV, has been seeking more substantial commitments of employers when submitting TDM plans. This pressure has already produced some important individual efforts, and promises to produce more.

In North Bethesda, the effect of the APFO has been more to slow development than to stimulate active TDM programs. The areawide TDM effort only began in 1987 with the formation of a Transportation Management Association, that received its stimulus from an ongoing building moratorium. Unfortunately, the program places most of the stimulus on land owners and developers, whose projects are stymied, and does little to require employers to participate in trip reduction programs. North Bethesda is listed as having no trip reduction impact based on judgment; no data are available to confirm this assumption.

Finally, there is the case of Hartford. Hartford does not have an ordinance that mandates trip reduction. The transportation management program was conceived and developed by the business community, over concern about high growth in the downtown and the lack of public action in enhancing the infrastructure. Because the employers, which are also the major land owners downtown, initiated the program, membership was voluntary and did not involve legal pressure. However, incentive to incorporate key TDM actions like parking management was difficult to achieve in the voluntary environment, particularly when the projected development boom failed to materialize. At the same time, improvements to transit and system level actions required from the public sector did not materialize, with the result that the travel options for most employees did not change significantly under the TDM program. It should also be noted that the TDM program has really focussed on the support of major employers, which means that about 60% of the downtown employment base was unaffected by the program.

In summary, evidence shows that TDM programs conceived under conditions where private sector support is motivated by legal concerns are more likely to gain the type of participation and implement the types of actions which reduce vehicle travel. Locations where parking supply is constrained are better equipped to support comprehensive TDM programs. As yet, the potential of TDM, as seen in a collective, areawide program which is not just a sum of individual efforts, has not yet been demonstrated.

Summary of Individual Employer TDM Program Accomplishments

In marked contrast to the experience with areawide programs, there are numerous examples of successful TDM programs implemented by individual employers or organizations. In many cases, the inclusion of these standout individual programs within an areawide program is the reason for the measured success of the latter.

Much can be learned from the individual programs, because the trip reduction effects can be tied more immediately to the specific TDM actions. By observing this cause-and-effect, valuable insight can be gained as to how areawide programs can be made more successful.

TABLE 3

SUMMARY OF TDM PROGRAM RESULTS AT SUBAREA LEVEL

Program	Setting	Legal Requirement	Percent Reduction
Downtown Bellevue	Suburban Activity Center	Yes	17.8%
Bishop Ranch	Suburban Business Park	Yes	16.6%
Minneapolis Free Parking	Regional CBD	No	15.0%
I-394 Interim HOV Lane	Radial Corridor	No	10.3%
Hacienda Business Park	Suburban Business Park	Yes	9.1%
Downtown Hartford	Regional CBD	No	2.4%
South Coast Metro	Suburban Business Park	Yes	NA*
North Bethesda Montgomery County	Suburban Activity Center	Yes	NA*

* Note: NA indicates that program has been operating for insufficient time or there exists insufficient data to determine subarea level trip reduction.

Table 4 lists eleven exemplary individual programs chosen from the various case studies. the table allows a side-by-side comparison of the results of these programs along with some key TDM elements. Table 4 shows the size of the particular program (employment base), the Vehicle Trip Production Rate (trips per 100 travelers) and the Percent Reduction in vehicle trips. These statistics are abstracted from Tables 2-A through 2-E. The table then indicates important contributing conditions at that site, in particular, the relative density of the area, whether there is a constrained parking situation at the site, and whether there is a prevailing legal requirement. Finally, the table indicates whether particular TDM actions have been applied, such as whether the employer charges for parking, and whether the employer makes strategic use of transportation allowances or subsidies to encourage high-occupancy vehicle use.

Several things are evident in examining the data and results in Table 2. First, it may be seen that trip reductions range from a low of only 5.5% at UCLA to a high of 47.6% at US WEST. But there are a number of programs with major reductions; six of the 11 sites have net reductions of greater than 20%. The average for the sites, in fact, exceeds 20%, which is considerable, remembering that this measure is the ***net*** reduction above ambient rates of non-drive alone use, which in some cases are quite high, e.g. Hartford and Bellevue.

The second thing to notice is that there is not a significant role played by employer size. While there are no examples of employers smaller than 400 employees in the group, there is no obvious correlation between employer size and the trip reduction rate. The largest employer in the list, UCLA, has the smallest reduction percentage, and one of the smallest, CH_2M Hill, has the second highest percentage. In theory, large employers have an edge in employee TDM programs due to the "large number" advantage in trip matching, and also somewhat in resources and corporate ethic. However, what seems to matter more is the specific components which are used in the program, and the enthusiasm with which they are applied.

The third item of interest is that these programs represent areas of all land use types, and density. Three are located in regional CBDs, judged to be high density areas; four are suburban activity centers, judged to be medium density; and the remaining four are located in suburban business parks, which are usually very low density areas. The sample, which is approximately evenly proportioned among these density classes, shows generally lower vehicle trip reduction indices in higher density areas (starting mode split has higher share of HOV use); however, there is no obvious correlation between density and net trip reduction. Again, it appears more important what the program consists of, than the physical environment in which it is implemented. Realistically, it would seem that programs in higher density areas have a greater potential for trip reduction.

What are the elements that separate the outstanding performers from the average ones? As the individual case studies will point out, all the programs listed here have in common the fact that they provide a wide range of alternatives to employees: carpool and vanpool programs, and higher quality transit service. However, the major difference among programs is largely explained by the incentives offered by the employer to encourage use of these improved alternatives in preference to driving alone.

TABLE 4: COMPARISON OF TOP INDIVIDUAL TDM PROGRAMS

Location	Program	Travel Base	Veh. Trip Rate	Pct. Reduc.	Area Density	Legal Req.	Restr. Park.	Parking Charges	HOV Allow./ Subsidy
Hartford	Travelers	10,000	42.8	25.4%	High	No	Yes	Yes	Yes
Hartford	Hartford Steam Boiler	1,100	49.6	13.6%	High	No	Yes	Yes	Yes
St. Paul	3M Company	12,700	82.7	9.7%	Low	No	No	No	No
Bellevue	US WEST	1,150	45.2	47.6%	Med	Yes	Yes	Yes	Yes
Bellevue	CH_2M Hill	400	59.4	31.2%	Med	Yes	Yes	Yes	Yes
Bishop Ranch	Pacific Bell	6,900	72.8	27.8%	Low	Yes	Yes	No	No
Hacienda Business Park	AT&T	3,890	80.5	13.4%	Low	Yes	No	No	No
Los Angeles	UCLA	18,000	79.0	5.5%	Med	Yes	Yes	Yes	No
Los Angeles	ARCO	2,000	55.3	19.1%	High	Yes	Yes	Yes	Yes
Orange County	State Farm	980	64.3	30.4%	Low	Yes	No	No	Yes
Montgomery County	NRC	1,400	53.7	41.6%	Med	Yes	Yes	Yes	Yes

It will be noted, therefore, that 8 of the 11 sites listed have some measure of restricted parking; only 3 do not. And most of these also charge employees for the privilege of parking; 7 of the total 11 sites, and 4 of the top 6 charge for employee parking. Perhaps equally important, the outstanding firms also offer counter pricing incentives as an alternative to driving: these include transit or carpool subsidies, which may be in the form of an allowance (ARCO, CH2M Hill), graduated parking fees (US WEST, ARCO, CH2M Hill, Travelers, Hartford Steam Boiler), or a direct subsidy payment (State Farm). The State Farm example is particularly attention getting because a subsidy payment is offered in lieu of parking charges, and yet they have been as successful as charge-for-parking programs.

It is also important to note that 8 of the 11 programs overall, and 5 of the top 6, were spurred in some manner by a prevailing legal requirement to manage traffic. Only the two Hartford programs, Travelers and Hartford Steam Boiler, and 3M in St. Paul, occurred without pressure from a local trip reduction ordinance or building code requirement. In the Hartford situation, there were major parking constraints which posed an economic burden to the firms, while at 3M, capability to build out at the site was being threatened. Unless this type of self interest is present, legal mechanisms may be credited with eliciting employer participation and implementing key TDM actions.

7. SUMMARY AND CONCLUSIONS

Based on the findings in this research study, it appears reasonable to conclude that Travel Demand Management is capable of having a significant impact on controlling the demand for low-occupancy vehicle travel and thereby reducing or postponing the need to add additional capacity to the highway system. Trip reductions such as those discovered could have a major impact on the demand for future infrastructure construction if TDM programs with the proper elements were implemented at a larger scale.

Important insight into the nature and potential for TDM has been provided by this study. Prior to this time, the actual accomplishments of TDM programs in reducing vehicle trips had been poorly understood. The research enabled by this study has helped substantiate three important points:

1) That TDM can **significantly** reduce low-occupancy vehicle trip demand at a site, in a corridor, or within a subarea;

2) The degree of success is directly determined by the specific components of the TDM program; and

3) To inspire use of the key TDM actions, either some type of legal pressure is necessary, or the individual firm must have a readily apparent, economic self interest in adopting these measures.

What level of trip reduction would be an acceptable expectation from TDM? Many professionals reason that even a 10% reduction in vehicle trip volumes could significantly

aid an area in alleviating current traffic difficulties. A 10% difference in a volume-to-capacity ratio could represent a order of magnitude difference in Level of Service, which would be felt in terms of traffic congestion.

However, a 10% reduction in vehicle travel will be relatively insignificant if viewed as a strategy to help the nation meet the projected enormous gap between vehicle travel demand and available capacity into the next century. A 10% reduction would be almost insignificant as a strategy to offset capital construction needs.

Placing modest expectations on TDM unfairly diminishes its potential to be a major factor in determining long-term infrastructure needs. This study has shown areawide programs that have achieved reductions approximating 20% (Bellevue at 17.8%), and individual programs with reductions in excess of 40% (US WEST at 47.6% and the Nuclear Regulatory Commission at 41.6%). These need not represent the upper limit of Travel Demand Management, but could help establish the norm.

The accomplishment of a TDM program depends entirely on the actions that are applied. If travelers are presented with no alternative that realistically competes with the private auto, they will not stop driving. And if driving continues to be subsidized in the form of free (or heavily subsidized) on-site parking, alternative modes will represent bad economic choices for travelers. If these factors are confronted by a TDM program, **trip reductions in the range of 20% to 40% can be the norm, rather than the exception.** Where TDM programs have been observed with average or limited trip reductions, it is obvious that these fundamental relationships have not been incorporated in the design.

Great potential exists for areawide TDM programs that has not yet been tapped. By grouping together the myriad interests in a transportation impact area, there should be considerable leverage in affecting travel conditions. If all employers or developers can be implored to implement the same control actions, the sharing of responsibility can have the effect of "leveling the playing field" for all participants, i.e., no small group will be expected to carry the burden for the entire community, and therefore experience an unfair burden. Beyond the sharing of responsibilities is a separate advantage of collective action. If all travelers in an impact area are responding to the same conditions, the opportunities for providing high quality alternatives is greatly enhanced. A larger base translates to greatly improved odds for ridesharing programs and transit service. This also leads to the situation where smaller employers begin to realize matching and service opportunities for their employees.

Thus far, no areawide TDM program has come close to approaching this ideal. Even the best programs are generally comprised of a small number of outstanding individual employer programs, typically large employers who can afford to act autonomously. No legal mechanism has yet been employed to cause this collective action, and voluntary appeals of a transportation management organization have gained only partial support and participation.

To realize the invaluable potential of TDM, conditions must be created that mirror those found in the successful cases in this study, and in particular the individual employer programs. This includes high-level alternatives and complementary economic incentives.

To cause these actions to occur will require legal impetus in most all cases. Such legal pressure need not be heavily prescriptive, and probably should not be, since each employers or subarea is likely to face somewhat unique conditions. However, there are particular actions which must occur if measurable reductions are to occur, such as parking management and incentives, and TDM implementors should be given education and direction in their selection and use. A good example of such guidance is Los Angeles' Regulation XV Air Quality Ordinance. The original transportation management plans required from employers required only a performance goal, namely achievement of an average vehicle occupancy of 1.5. Experience with original plans, evaluated through employee travel surveys, has now caused the Air Quality Management District to increase the requirement for plans to include obvious economic incentives. In turn, the new plans are showing a variety of innovative measures from the employers, with growing evidence that trip reductions are being realized.

In summary, the potential for TDM appears to be limited only by expectation built around conventional experience with many programs that have achieved minimal results. The key to TDM is use of the right strategies. If this can be accomplished, there is ample evidence in this report that significant trip reductions can be realized. Perhaps even more important than the short-run benefit of TDM in reducing current travel, is the longer term potential to shape locational and land use choices: if travelers are faced with finding alternative travel choices today, it may well influence locational patterns of individuals and firms so that tomorrow's travel markets may not be as dispersed and difficult to serve with travel alternatives.

Review of the individual case studies which have been compiled in the study report is encouraged. Only by reading the complete case study can the interested professional get a full understanding of the motivations behind the individual programs and the key elements which have made them a success.

CASE STUDIES

1. CASE STUDY: HARTFORD, CONNECTICUT

1. SITE DESCRIPTION

Location and Character of Site

Hartford, located in central Connecticut, is the state capital and is probably best known as the insurance capital of the U.S. According to the 1980 census, the city's population was 167,000, compared to a regional population of over 1 million. The region, comprised of three counties, has experienced some growth over the past 20 years, but Hartford County has remained relatively stable.

Despite suburban growth trends, downtown Hartford remains the region's commercial, government and finance center, as well as its principal employer. The downtown area includes the central business district, the capitol area and Asylum Hill. Approximately 100,000 employees work in this area, with a large portion of these jobs associated with the seven major insurance companies which are headquartered in Hartford.

The vitality and regional dominance of downtown Hartford is heavily influenced by the insurance industry. The insurance companies are not only the region's major employers, but they are also among the major landowners. So, downtown Hartford has actually been experiencing an economic and development upswing despite a stable region and a period of general decline in the Northeast. Since 1970, over $200 million of private and public funds have been invested in downtown Hartford. More than 3 million square feet of office space were completed in the early 1980's, representing as much space as had been constructed in the past 20 years. While growth slowed somewhat in the mid-1980's, another 4 million square feet of space has been approved for construction and another 2 million have been proposed.

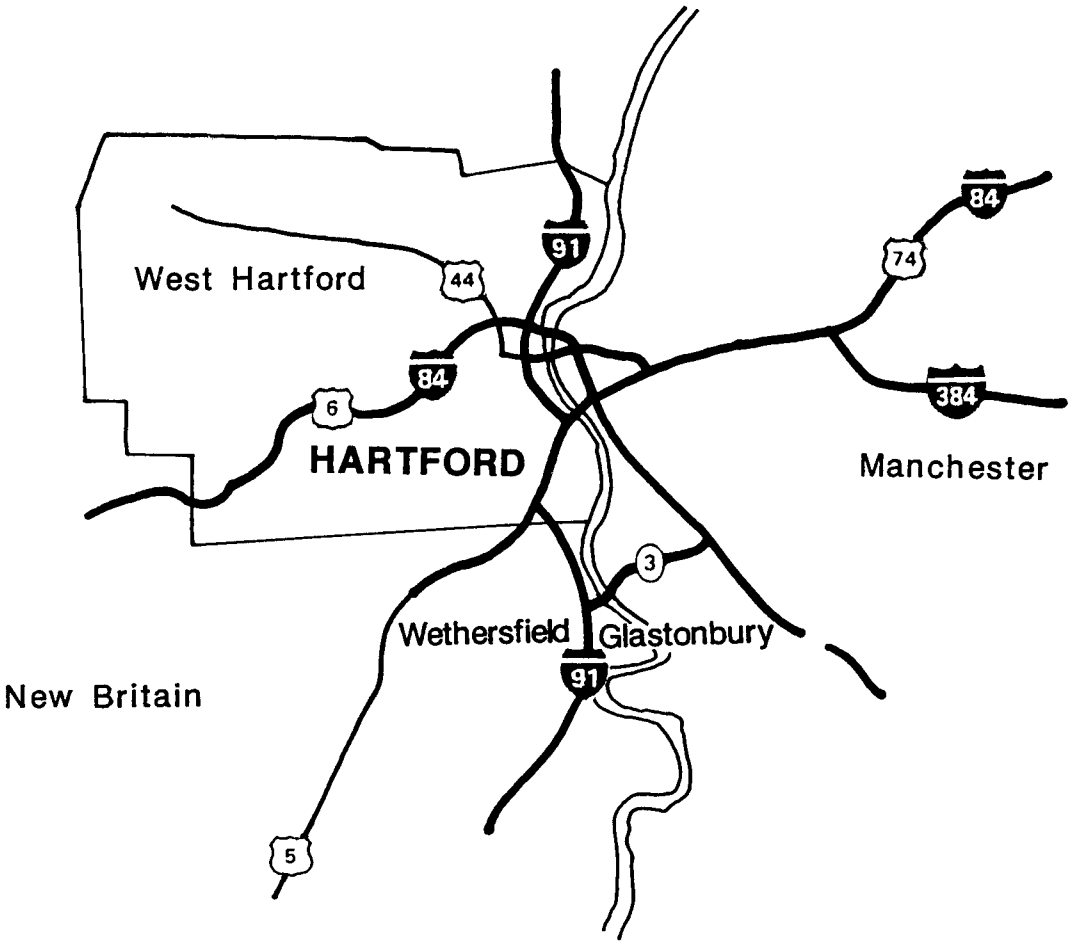
Transportation Facilities

As seen in Figure 1, Hartford is located at the intersection of Interstates 91 and 84. While this location suggests good regional access, connections between these highways are poor. Several connectors require using downtown streets, and this contributes to delay on the freeways and congestion on downtown streets. Plans to construct a beltway around the city in the 1960's were never realized, and as a result, significant numbers of long-distance travelers are channeled through the center of town on the two interstates. This through traffic adds to the already-congested conditions caused by local peak period commutation.

While the auto is still the primary mode of travel to downtown, several alternatives exist. Public transit service is provided by Connecticut Transit, which operates a fixed-route bus network that includes 230 peak period vehicles, and carries over 22 million trips per year. In addition, demand responsive service is provided by the Greater Hartford Transit District, and a segment of commuters make use of Amtrak service between New Haven and

FIGURE 1

MAP OF GREATER HARTFORD



Springfield. The Greater Hartford Ridesharing Corporation provides assistance with ridesharing programs and other commuter assistance to employers.

2. BACKGROUND AND MOTIVATION FOR TDM PROGRAM

As of 1982, when major interest in transportation management began in Hartford, the share of commuters reaching downtown by driving alone was 48%; transit users accounted for 31%, and persons in carpools and vanpools averaged 21%. The projected increase in employment in the downtown alerted local public and private leaders that traffic congestion problems would become severe unless measures were taken to resolve them.

Conventional traffic management techniques seemed limited in their potential relief. With the exception of major reconstruction of the two interstates, the transportation infrastructure in Hartford was mature and reasonably fixed. Transit service also was not in a position to expand, but rather was being stretched increasingly to meet the demands of the growing suburbs.

Local officials judged parking to be a key factor contributing to the downtown's transportation difficulties. Over 80% of the estimated 21,700 parking spaces serving downtown Hartford were found to be privately controlled. Corporate policies governing the location, pricing and utilization of these spaces were seen as a significant encouragement to drive-alone auto commuters, who dominate use of the spaces. Data indicated that about 75% of employee parking was free or heavily subsidized by employers, compared to a national average of 35 to 40% for major downtowns. In turn, demand for these spaces by long-term commuters resulted in a severe shortage of short-term spaces for business or shopping.

The business community's vested interest in the continued economic vitality of the downtown forced it into a proactive role regarding the traffic and mobility problems. The area boasted a strong Chamber of Commerce, with a history of involvement in transportation and other broad reaching local issues. The Downtown Council, formed in 1974, became a forum for such issues and funded several transportation-related studies. Perhaps the most important of these was the Downtown Hartford Transportation Project (DTHP), undertaken in 1981 as a joint public-private effort. The project was designed to investigate management solutions to the areas transportation problems, knowing that efforts to enhance the existing infrastructure would be very limited.

The DTHP project reached strong conclusions about the need to control congestion, manage the parking supply, and improve the street environment. But one of the most important conclusions was that the public and private sectors needed to organize into a body capable of providing the appropriate responsibility "umbrella" necessary to manage the transportation system. This conclusion resulted in the designation of the existing Greater Hartford Ridesharing Corporation (GHRC) and the City's Department of Public Works as the respective private and public nucleus of a new Transportation Management Organization, or TMO.

The DTHP study accelerated the efforts of the TMO with a list of 33 action strategies that it had recommended for implementation. These included transportation facility management (TSM) measures, parking management strategies, transit and rideshare enhancement strategies, and improvements to the street and pedestrian environment.

The only two measures not to appear in the TMO's initial workplan from the list recommended by the DTHP were the phasing-out of employee parking subsidies and the phasing-in of employee transportation allowances. The prevailing sentiment of the business community was to study these issues more carefully and ensure that alternatives were in place before proceeding with actions as stringent as parking management.

Major employers belonging to the TMO, representing about 40% of downtown employment, submitted to a survey which indicated their current modal splits, and served as a basis for setting trip reduction targets as part of the management program. Goals were set that targeted a 20% improvement in rates of use of high occupancy vehicle modes over the three-year period 1984 through 1987. To achieve this goal the employers were encouraged to foster such TDM actions as increasing ridesharing efforts, increasing transit subsidies, implementing flextime, and allowing shared use of corporate vanpools. At the same time the TMO worked with the city to structure a new zoning ordinance providing density bonuses or reduced parking for developers in exchange for TDM measures, and for street improvements to improve flow and circulation. The TMO also worked with the transit agency toward establishment of a downtown shuttle service, and park and ride services.

3. OVERALL EFFECTS OF PROGRAM

Despite strong efforts toward each of the above actions, Hartford's TDM program fell somewhat short of its trip reduction goal. Data compiled by the DTHP study in 1981 indicated a mode split rate of 48% drive alone, 21% ridesharing and 31% transit. As shown in Table 1, a comparative estimate developed by the TMO in 1987 using employee survey data suggested that the drive alone rate had fallen to 45%, while the rate of ridesharing had increased to 25%, and transit had fallen slightly to 30%.

To assess the effectiveness of this trip reduction program, an index is calculated that reflects the number of vehicle trips generated by each 100 employees. The index assumes 30 person trips for each transit vehicle trip and 2.5 persons for each ridesharing vehicle trip. This corresponds to a trip generation rate of 56 vehicle trips per 100 employees in 1987, down 1.4 trips from a rate of 57.4 per 100 in 1981 (Note that the assumption of 2.5 persons per rideshare unit probably understates the average occupancy due to vanpooling; however, no information was available on the percentage of travelers using vanpools). To gauge the impact of this change, if the 102,000 employees in downtown Hartford in 1987 traveled at the mode split rates that existed in 1981, they would have generated an additional (57.4 - 56.0)/100 x 102,000 = 1428 daily one-way vehicle trips. Therefore, the TDM program may be credited with a net trip reduction of (102,000)(.574 - .560)/(102,000 x .574) = 2.4% over 1981 levels.

TABLE 1

VEHICLE TRIP REDUCTIONS IN DOWNTOWN HARTFORD

	Hartford Downtown 1981	Hartford Downtown 1987	TMO Goal
Employment	100,000	102,000	110,000
Travel Mode			
Drive Alone	48%	45%	39%
Carpool	21	25	28
Transit	31	30	33
Vehicle Trips per 100 Employees *	57.4	56.0	51.3
Average Vehicle Occupancy	1.74	1.79	1.95

* assumes 2.5 persons per carpool and 30 persons per transit trip

The ultimate goal of the TDM program to reach a mode split of 39% drive alone, 28% rideshare and 33% transit would have required reaching a trip generation rate of 51.3, a reduction of 6.1/57.4 = 10.6% over the 1981 rate, compared to the 2.4% that was achieved. Failure to reach the trip reduction goal did not have serious implications on the downtown, largely because the projected growth in downtown development and employment did not occur. Only about half of the projected development for this period actually occurred, meaning that only about 2% of the projected 10% increase in jobs was realized. Thus, the 2% increase in employment matched by a 2.4% reduction in vehicle trips satisfied the practical goal of the TMO that traffic conditions not get any worse.

However, the prospect of ultimate traffic congestion continues to threaten the downtown as development activity continues. The TMO is particularly concerned that, without a concerted effort toward parking management, future progress toward trip reduction goals will be severely limited. Strategic data have been obtained through surveys and studies which confirm the high cost to employers of providing parking to employees as well as the incentive role played by parking on employee mode choice. The average Hartford employer surveyed by the TMO was found to subsidize drive alone employees by about $715 per year, compared to only about $50 per year for transit users. The TMO is working actively with employers to try to implement a comprehensive parking management program. As yet, however, most employers have rejected the concept because: (1) they feel the alternatives are still not in place, and (2) they consider free parking an important fringe benefit through which they compete for employees.

4. INDIVIDUAL PROGRAM EFFORTS

A large measure of the credit for existing trip reduction levels in downtown Hartford must be given to two employers and the comprehensive programs they have implemented. These employers are the Travelers Insurance Company and Hartford Steam Boiler. Both are members of the TMO, and have been exemplary in both fostering improved alternatives to employees and providing the appropriate balance of incentives and disincentives to encourage their use. Below are brief summaries of each program.

Travelers Insurance

Travelers is largest insurance company in Hartford, employing about 10,000 people at its downtown site. Through a combination of "natural" locational advantages and company support with some important transportation program measures, Travelers has achieved a modal split among its employees of:

Drive Alone	33.2%
Carpool	19.4
Vanpool	8.0
Transit	36.2

The two locational advantages are (1) a relatively constrained parking situation for its large workforce, and (2) proximity to good transit service, both local and express.

The constrained parking at Travelers is not so much a matter of space ratios or cost as convenient access. Travelers owns or leases facilities which account for about 4700 parking spaces. This is about 1 space for every two employees, or expressed another way, if each employee occupies about 200 square feet of office space, this would be a space ratio of about 2.35 spaces per 1000 sq. ft. These spaces are located in 8 different places. Only about 1500 spaces are located on site, in 2 facilities, most being within a garage owned by Travelers. The waiting list for a space in this garage is 3 to 4 years long.

The company charges employees to park in its spaces, but the charges are very nominal. Travelers pays between $30 and $70 per space per month for its facilities, and charges employees according to vehicle occupancy for their use. Single-occupant commuters are charged $25 per month; carpools with 2 occupants are charged $15 per month; and ridesharing units with 3 or more occupants are allowed to park free. Even with the charge, the company parking is a reasonable fringe benefit to employees, considering that the market rate for parking in the immediate area averages about $200 per month. But the disincentive to driving alone is that the parking off-site requires a considerable walk. Carpools and vanpools are offered priority parking in the on-site facilities.

While Travelers program has resulted in about 19% of its employees taking carpools to work, it also boasts a significant numbe.· of people in vanpools and transit. The vanpool program is quite active, with approximately 800 employees traveling in 67 vanpools. The company subsidizes the vans to provide an equivalent benefit to employees who vanpool of about $20 per month.

But above all, Travelers has taken advantage of its location to get maximum usage of transit service. Over 36% of its employees ride transit to work, which is assisted greatly by the location of the company's offices immediately adjacent to the downtown terminus of many local and express services. The company offers a monthly subsidy of $15 to employees who use transit. About 20% of the company's employees reach work by express bus, and the company has been instrumental in establishing many of these services.

The high percentage of employees using either vanpools or transit is significantly responsible for the impressively low vehicle trip generation rate. Assuming 2.5 persons per average carpool, 12 per vanpool and 30 per transit trip as before, Travelers' 10,000 employees generate about 4280 vehicle trips, or about 42.8 per 100 employees.

How significant a *net* trip reduction is this? Before-program data are not available for Travelers, but Travelers' achievements can be compared with two standards: (1) the average of all downtown businesses in 1981 before the TDM program, and (2) a firm of comparable size and function whose TDM efforts are comparatively minimal. The comparative data are listed in the following table:

	Travelers	1981 Downtown Average	Non-TDM Company "B"
Employment	10,000	100,000	9,000
Travel Mode			
Drive Alone	33.2%	48%	77.6%
Rideshare	27.4	21	14.3
Carpool	(19.4)		(9.7)
Vanpool	(8.0)		(4.6)
Transit	36.2	31	6.5
Vehicle Trips per 100 Employees*	42.8	57.4	82.1

* assumes 2.5 persons per carpool and 30 persons per transit trip

If Travelers program is compared with the result for the entire downtown, pre-TDM program, Travelers' program is reducing an additional 57.4 - 42.8 = 14.6 vehicle trips per 100 employees. This means that travelers efforts have taken an additional 1460 daily vehicle trips off the highways than could have occurred in the absence of their program. This corresponds to a (10,000 x .146)/(10,000 x .574) = 25.4% net reduction attributable to the TDM program.

The program at the non-TDM Company offers a good comparison to Travelers. The comparison company is not located in the center of downtown, so it does not have access to the same quality of transit service. However, it does not subsidize its employees transit passes as does Travelers, nor has it worked as diligently with the transit operator to establish effective service arrangements. Neither does Company "B" manage its parking. Its spaces cost the company $45 per month, and employees are charged nothing for their use. The company does provide some preferential parking for HOV users, and a vanpool subsidy roughly equal to Travelers', which values about $20 per month.

The result is that Company "B" does not have nearly as many employees in alternative modes as Travelers. Approximately 82.1 vehicle trips per 100 employees are calculated from the indicated mode split. If Travelers' rate of 42.8 vehicle trips per 100 is compared with Company "B", Travelers' efforts result in an additional 39.3 trips reduced per 100 employees. This means that, for Travelers' 10,000 employees, its efforts are responsible

for an additional 3930 vehicle trips taken off the road than would have occurred under a program with the components of a company of equivalent size and stature, but without an equivalent TDM program.

Hartford Steam Boiler

Hartford Steam Boiler is a second interesting example in Hartford, owing both to its level of trip reduction and its size. Hartford Steam (HSB) is also an insurance company, so it is a professional, white collar employer. And while it is a large employer, with about 1,100 employees, it is not of the same scale as Travelers or many of the other major employers in the downtown.

Like Travelers, Hartford Steam (HSB) has two factors working in its favor, which have contributed heavily to the success of its TDM program: It has relatively constrained parking, which it prices strategically for incentive purposes; and it makes maximum use of nearby transit service.

Largely by design, there are only 233 spaces available through the company for HSB's 1100 employees. This means almost 5 employees for every space, or, if a space ratio of 200 sq. ft. per employee is assumed, only about 1.05 spaces per 1000 sq. ft.-- a very constrained parking ratio. The company makes other spaces available off-site through a lease arrangement which costs employees $30 per month.

The on-site spaces cost HSB $110 per month. They in turn charge single-occupant employees $110 for the space, and offer a sliding scale for HOVs. The rate for 2-person carpools is $75 per month; for 3-person carpools it drops to $40 per month; and for pools with 4 or more occupants the charge is $10 per month. As an added incentive, rideshare employees are given priority use of the on-site facilities.

The constrained parking makes the alternatives to driving alone undoubtedly look better. Almost 36% of all employees use transit to get to work, which the company also subsidizes at rates between $15 and $30 per month. Of those who rideshare, the great majority are in carpools -- 20.9% While the company offers incentives to vanpool, in form of a subsidy that amounts to between $10 to $30 per month, only 1.3% of the company's employees commute in vanpools.

To ascertain the net effectiveness of HSB's demand management program, a comparison is again made with the downtown business community as a whole, pre-TDM program, and also a similar firm with a minimal program. Comparison Company "D" in this case is located near enough to HSB to enjoy the same transit advantages, and they employ about 900 of the same type of workers. Comparative results are listed in the following table:

	HSB	1981 Downtown Average	Non-TDM Company "D"
Employment	1,100	100,000	900
Travel Mode			
Drive Alone	39.9%	48%	63.0%
Carpool	20.9	21	9.1
Vanpool	1.3		0.5
Transit	35.9	31	24.1
Vehicle Trips per 100 Employees*	49.6	57.4	67.5

* assumes 2.5 persons per carpool and 30 persons per transit trip

In review of the data, even though HSB's program has not produced a trip reduction rate that is as low as Traveler's, it is still quite impressive. Compared to the downtown average, the vehicle trip rate at HSB has taken 57.4 - 49.6 = 7.8 daily vehicle trips per 100 more from the roads than would have occurred in the absence of its program. On a base of 1100 employees, this means 86 vehicle trips per day reduced, equating to a (1100 x .078)/(1100 x .574) = 13.6% net reduction due to TDM.

The program at Company "D", as a comparison, involves some TDM incentives. Company "D" also charges its employees for parking, an average of about $50 per month, and also provides a discount to employees who rideshare. They also offer a vanpool subsidy of $15 per month, and a transit pass subsidy of between $12 and $15 per month. This is actually a fairly ambitious program. The major difference is that Company "D" is not particularly active about its program in terms of corporate backing and promotion. Less than half as many people rideshare at Company "D" as at HSB, and about two-thirds as many take transit. The result is a vehicle trip rate of 67.5 per hundred, which is 67.5 - 49.6 = 17.9 more than Company "D". Hartford Steam's program is able to reduce 1100 x 17.9/100 = 197 more vehicle trips than the program at Company "D" or (1100 x .179)/ (1100 x .675) = 26.5%. So the lesson for this example seems to be that the spirit in which a TDM program is offered can be almost as important as the particular transportation components of that program.

2. CASE STUDY: NUCLEAR REGULATORY COMMISSION

MONTGOMERY COUNTY, MARYLAND

1. SITE DESCRIPTION

Location and Character of Site

The Nuclear Regulatory Commission (NRC) is an agency of the Federal Government that has been involved in the consolidation of its staff and operations into Montgomery County, a suburb of Washington, D.C. Growth management controls applied to the consolidation under Montgomery County law have produced some very interesting results regarding the potential of Travel Demand Management actions.

Montgomery County, Maryland is a fast-growing suburban area located just northwest of the District of Columbia. Its location in the capital region is shown in Figure 1. This 500-square-mile county was largely a residential bedroom community for Washington, D.C. commuters prior to 1980. However, since that time, Montgomery County has followed the trend of most "first-ring" suburban counties in the nation's capital area in becoming a major employment center. In 1985, the County was the home for 236,000 households and 371,000 jobs. Comparing these totals with 191,000 households and 247,000 jobs in 1975 indicates the substantial growth that has occurred in the county, particularly as an employment center.

The new headquarters of NRC is located in an area known as North Bethesda, one of 15 planning subareas in the county. The location of North Bethesda and its size in relation to the county is also illustrated in Figure 1. It lies midway between two existing suburban centers, downtown Bethesda and the City of Rockville. This location relative to the transportation system and other activity centers has helped fuel North Bethesda's growth as a job center, producing traffic levels that have brought the area into conflict with the county's growth policy.

In the period prior to its employment surge, North Bethesda was primarily known as the location of Rockville Pike, a major retail strip district that has become increasingly upscale with time. However, as of 1987, employment in North Bethesda had reached 55,000, over 80% of which is office employment centered in four primary locations. One of these centers is the area along Rockville Pike itself, which is where NRC is located, as shown in Figure 2. North Bethesda is also a significant residential community, with approximately 13,000 housing units in 1987.

Transportation Facilities

Much of what has made North Bethesda such an attractive growth location is its excellent location in the region's transportation system. It lies at the base of the Interstate 270 corridor, where I-270 intersects with the Capital Beltway, I-495. I-270 is a six-lane facility which is in the final stages of a major expansion to twelve lanes. The Capital Beltway is

FIGURE 1

MAP ILLUSTRATING LOCATION OF NORTH BETHESDA

IN RELATION TO MONTGOMERY COUNTY AND WASHINGTON, D.C. REGION

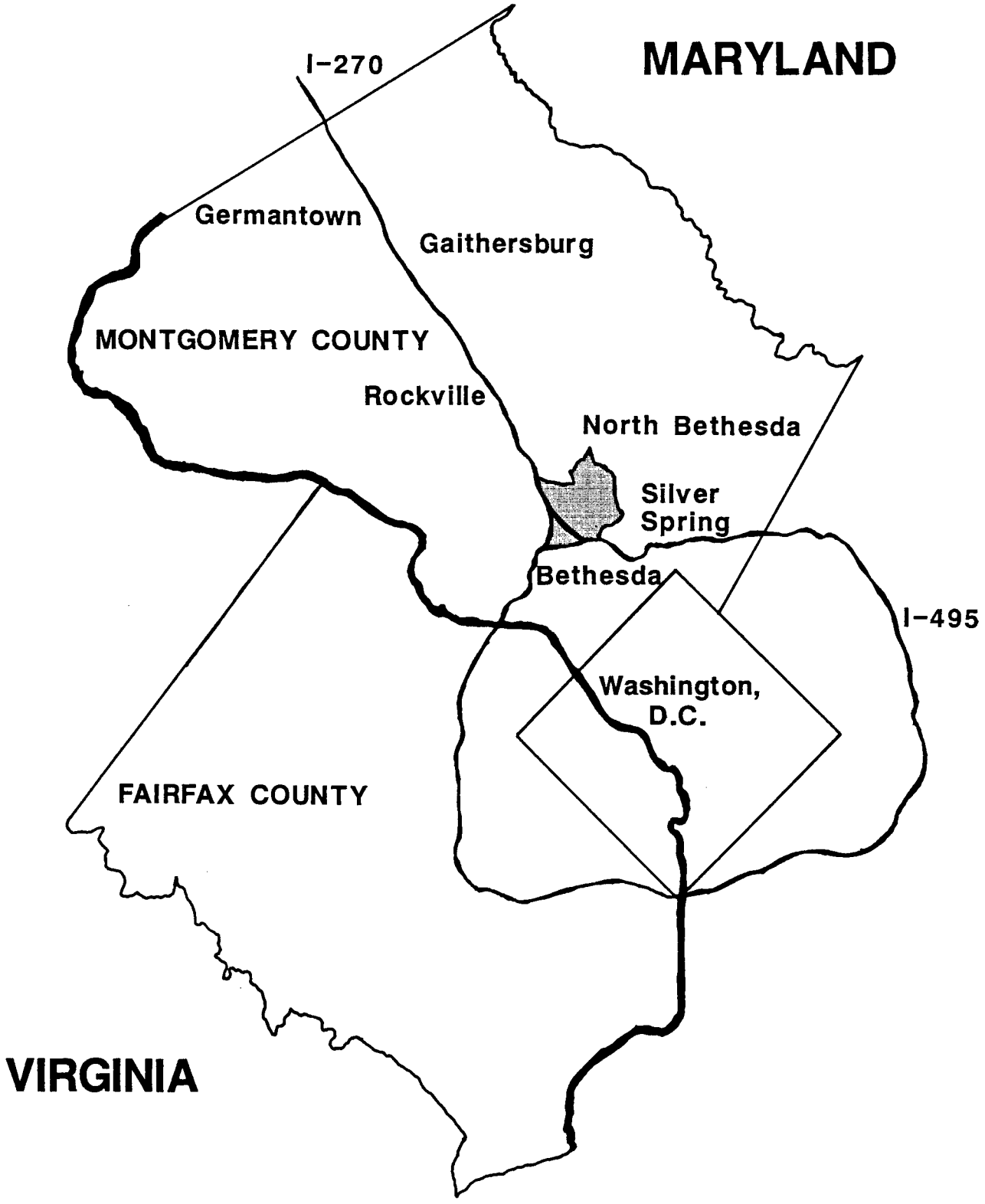
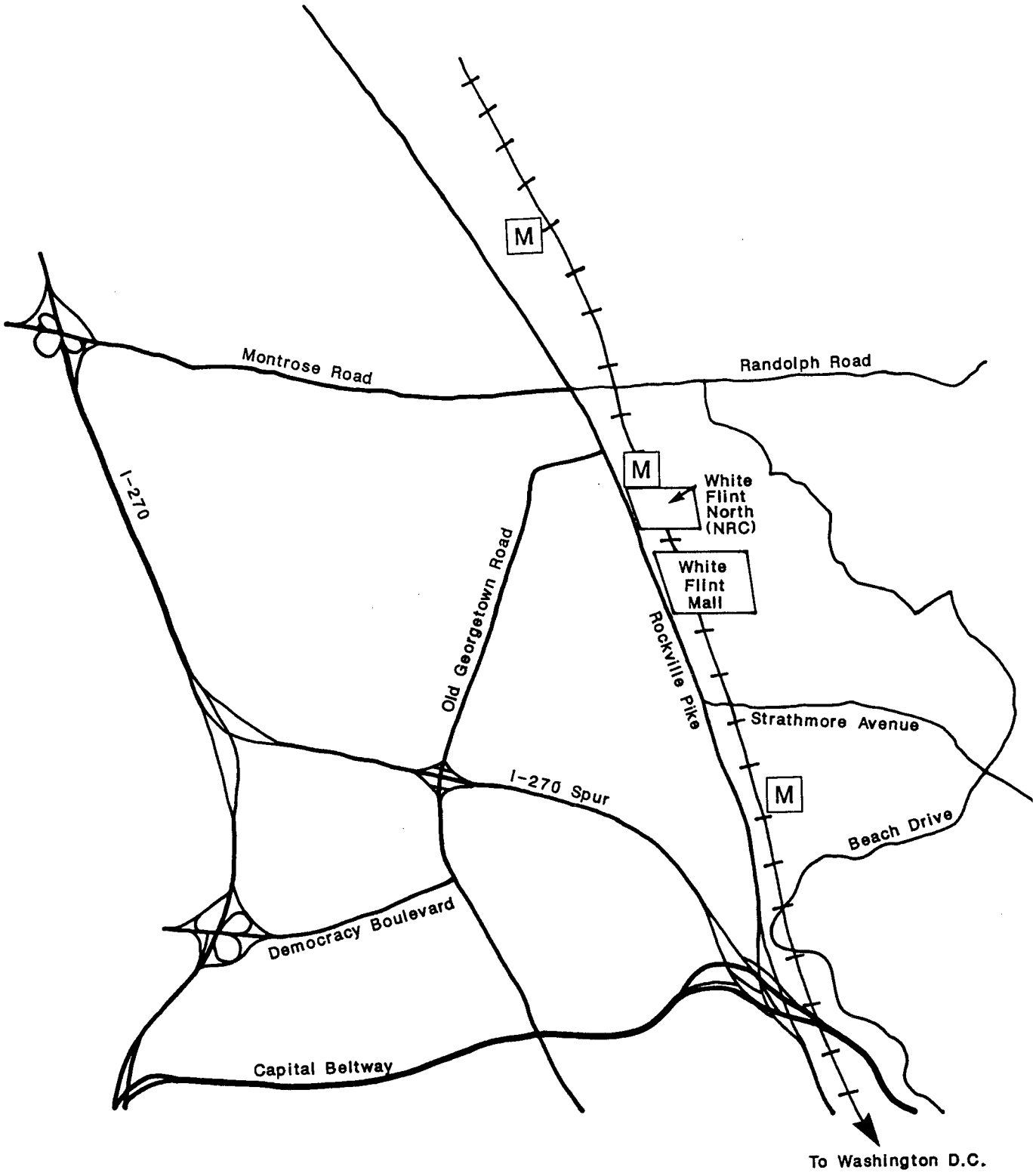


FIGURE 2

MAP OF NORTH BETHESDA

SHOWING LOCATION OF NRC AND MAJOR TRANSPORTATION FACILITIES



similarly undergoing an expansion from six lanes to eight lanes. These freeways make North Bethesda something of a regional gateway, which has proved to be a mixed blessing in terms of traffic. While the area the area is also served by some major six-lane arterials, such as Rockville Pike, Old Georgetown Road, Democracy Boulevard and Montrose/Randolph Roads, there are some key traffic movements that are not well accommodated by the existing network, which produce some serious flow problems.

Public transportation in the area is provided both by the county and the regional transit authority. The regional Metrorail system's Red Line runs north-south through the center of the area, roughly parallel to Rockville Pike, with three stations serving North Bethesda. Both the Washington Metropolitan Area Transit Authority and Montgomery County (Ride-On) provide fixed-route bus service through the area, largely oriented as feeder operations to the Metrorail system.

2. BACKGROUND AND MOTIVATION FOR TDM PROGRAM

Montgomery County is a striking example of a community that has taken major strides to try to balance the forces of economic growth with the interest of maintaining a high quality environment in which to live. Driven by its highly educated and relatively affluent population, County elected officials and planners have developed an advanced system of controls to try to moderate the impacts of growth.

Central to this system of controls is the county's Adequate Public Facilities Ordinance, or APFO. Enacted in 1973, the APFO places stringent tests of capacity on new developments related to the ability of public services to accommodate those developments. Two of the most stringent tests apply to transportation and schools. The County may withhold permits from landowners if the projects violate established capacity standards. In transportation, the APFO prescribes an average Level of Service that is to be maintained in each planning area, with the closer-in, higher density areas allowed a lower level of service (D and up) than the more rural upcounty planning areas (generally C). North Bethesda has been under a development moratorium since 1987 when it was realized that development projects either on line or for which construction permits had been granted, would consume the transportation capacity that is projected to exist through 1995.

Would-be developers can influence the likelihood of acquiring a building permit from the county by offering to establish trip reduction programs as a condition of project approval. In most of these cases, the developer is asked to back the transportation management agreement with a letter of credit, redeemable to the county in the event the proposed trip reduction is not met within a specified time frame. In other instances the county has granted conditional approval to a project, allowing an initial phase to be developed with approval on subsequent phases contingent upon whether trip reduction targets are met on the previous phase.

3. OVERALL EFFECTS OF PROGRAM

The County has been instrumental in initiating areawide management approaches in several locations where there are growth/traffic problems to help the areas resolve those difficulties and comply with the APFO. As examples of the above, the County has established:

- o A Transportation Management Association in North Bethesda that includes both developers and employers and exists as a vehicle to seek resolution of the area's transportation capacity problems through collective action.

- o A Transportation Management District in Silver Spring that has the responsibility of reducing private vehicle tripmaking among all employers, both new and existing;

- o An Urban District in downtown Bethesda which is responsible not only for collective resolution of traffic problems, but for the upkeep and promotion of the area as a place to live and work;

- o A Parking District in Bethesda to manage the parking supply to the best advantage of the area in terms of traffic management goals;

As yet, there is insufficient information at an areawide level on how well these collective efforts are performing. However, there are some important results at the individual project level. NRC is one of those programs.

4. THE NUCLEAR REGULATORY COMMISSION EXAMPLE

The Nuclear Regulatory Commission employs about 2,450 people, which, prior to its proposed move to North Bethesda, were headquartered in eight different locations throughout the metropolitan area. When looking for a consolidation site for the NRC, the General Services Administration (GSA) was attracted to a site at White Flint North, an area of mixed retail and office development lying east of Rockville Pike and just north of White Flint Mall in North Bethesda. The reasons for the attraction were twofold: more than 60% of NRC's staff already lived in Montgomery County, and the site itself adjoined a Metrorail station, which was also a transfer point for feeder buses. GSA purchased the 310,000 sq. ft. One White Flint North building from its developer while it was still under construction. This single building was not enough to meet NRC's entire staff needs, so GSA also executed a lease for a planned second building at the site, that would remain under the developer's ownership.

As a privately-owned building, however, the second facility required approval under normal Montgomery County development review procedures. Viability of the project initially depended on county approval of a revised development plan, since the original plan called for a hotel and conference center at the site. Even if the revised site plan were approved, the project faced the sterner test of the Adequate Public Facilities Ordinance. Heavy commuter traffic along Rockville Pike caused the county to establish strict trip generation limits for the White Flint North site.

NRC's plans were dealt a further blow when a 1986 survey of employee commuting patterns revealed that most staff members intended to drive to the new complex. Based on these reported travel preferences, estimates were made of the probable trip generation rates at the new site. It was evident that the peak-hour trip generation from the first building alone would far exceed the county's limit of 465 trips for the building. Completing NRC's consolidation with the second building would mean exceeding the 640-trip limit assigned to the entire 13-acre site in the approved development plan.

Faced with the certainty that under these circumstances Montgomery County would not approve the revised development plan, it became a critical objective to both the NRC and the developer to find a way to improve the employee travel situation and satisfy the county's regulations. With 18 months remaining before the scheduled initial occupancy, the NRC and GSA, with the help of the developer and its attorney, consultants and the NRC employees' union, launched a major effort to develop a transportation management plan (TMP).

Formulation of the TMP considered the widest possible range of options, including specialized transit services, ridesharing programs, flexible work hours, and a variety of financial incentives and disincentives, featuring parking management strategies. Options were tested out on the employees through another survey, which indicated concern that travel to the new site would be restricted, but also acknowledgement that alternatives to driving alone might be more attractive.

With the help of the Montgomery County Department of Transportation, a TMP was established and put into effect in early 1988 with the beginning of occupancy of the first building. The plan contained the following elements:

- Fee Parking -- All parking space formally available to NRC staff was charged at market rates; rates were $60 per month at the 365-space in-building garage, and $30 per month at a surface lot some blocks away.

- Transit Discounts -- Whereas Montgomery County maintains a program which offers matching discounts to employers who subsidize employees transit use, the NRC as a federal agency was prohibited from furnishing such subsidies; however, the county's transportation director agreed to make a 20 to 25% discount available without a matching subsidy. NRC purchases discounted fare cards, passes and bus tokens from the county and sells them to staff at a central building location, along with schedule information.

- Carpools -- Carpools of two or more riders are guaranteed space in the building's garage, but are offered no discount. NRC's transportation office provides a carpool matching service.

- Early Work Hours -- NRC's standard working hours were changed from 8:15 a.m./5:00 p.m. to 7:30 a.m./4:15 p.m. Moreover, flexible arrangements were offered to allow employees to start and leave even earlier. This element marked the first time that a federal agency had altered it work schedule in response to a local traffic problem.

- Nearby Parking Restrictions -- To backup its parking fee program, NRC informed employees that cars violating parking restrictions in posted areas near the building would be ticketed and towed. In addition, the developer obtained an agreement from owners of nearby shopping centers to tow illegal all-day parkers.

- Transit Shuttle -- The developer has also made an offer to subsidize a commuter shuttle that would supply a link currently missing in the public transportation system. Persons wishing to travel to jobs in North Bethesda from areas to the east (estimated 14,000 travelers) currently have no effective transit option. The developer's proposal would subsidize a bus service that would run between a new county park and ride lot and several job centers in North Bethesda. Since commuters other than NRC employees would use the service, the developer would receive the trip credit toward the White Flint project. A final decision on the shuttle service will be made in 1989.

NRC began its occupancy of White Flint North in early 1989, with the relocation of 1,400 of its 2,450 staff into the first building. According to the pre-consolidation 1986 employee survey, 54% of the NRC staff drove to work most of the time, 25% normally carpooled, and less than 11% used public transit. The modest transit use was particularly striking since all eight former office locations were within walking distance of Metrorail. In June 1988, four months after the initial occupancy, a subsequent survey indicated that only 42% were driving alone, 27% were carpooling and 28% were using public transit. Moreover, traffic monitoring at the building indicated that the majority of those who did drive alone were arriving at work before the start of the morning peak hour (7:30 - 8:30) and most were leaving either before or after the evening peak hour (4:45 - 5:45).

Table 1 presents summary data that provides an assessment of how effective NRC's Transportation Management Program has been. The modal split is indicated for NRC before and after its relocation, with a basis provided for calculation of the trip reduction. To perform the calculation, the measure of Vehicle Trips per 100 Employees is once again employed. This measure assumes a vehicle occupancy rate of 1 person for every drive alone trip, 2.5 persons for every carpool vehicle trip, and 30 persons for every transit vehicle trip. Based on this assumption, the NRC transportation management program for White Flint North has reduced vehicle trip production by 16.6% over its employees previous travel patterns. On a base of 1400 employees, this is an implied reduction of 232 daily one-way vehicle trips.

A much more striking comparison comes when NRC is related to North Bethesda as a whole. As part of the County DOT's North Bethesda Traffic Mitigation Study in 1987, an employee travel survey was conducted in North Bethesda that revealed the modal split shown in the last column of Table 1. Using this profile as a more relevant base of comparison, NRC's employee travel patterns are radically different from the heavily auto-oriented North Bethesda environment; almost 90% of all commuters to North Bethesda regularly drive alone. Against this base, NRC can claim a vehicle trip reduction of 41.6%. Applied to NRC's employee population of 1400, this implies 582 daily one-way vehicle trips averted, a very significant reduction.

TABLE 1

SUMMARY OF EFFECTIVENESS QF TDM PROGRAM

NUCLEAR REGULATORY COMMISSION

	NRC, Post-Relocation	NRC, Pre-Relocation	North Bethesda
Travel Mode			
Drive Alone	42%	54%	89.5%
Carpool	27	25	6.5
Transit	28	11	4.0
Other	3	10	0
Average Vehicle Occupancy	1.59	1.47	1.04
Vehicle Trips per 100 Employees*	53.7	64.4	91.9
Percentage Reduction		16.6%	41.6%

* assumes 2.5 persons per carpool and 30 persons per transit trip

NRC's trip reduction program is working so well that the building's peak hour trip generation is only two-thirds of the level anticipated by Montgomery County planners. The program's success led the Montgomery County Planning Board to unanimously approve the revised site plan proposal for the White Flint North site in April 1988. The revised plan includes a second 364,000 sq. ft. building for NRC, incorporating ground-floor retail, plus 200 apartment units on the site. However, this approval rests on the continued effectiveness of the TMP, which will be periodically monitored.

Although successful, the program is not without problems. The parking fees are not a complete deterrent to solo drivers. Many will pay the price, and other options exist for those willing to accept some inconvenience. Less than 40% of the employees who drive alone to NRC park in the assigned market-rate spaces. Some use the substantial amount of free legal on-street parking in the general vicinity, and others take advantage of a free, practically empty State of Maryland commuter lot a quarter mile away. In contrast, almost 70% of those who carpool park in the building's garage, taking advantage of the cost savings and space incentive. Investigations have shown that the carpool matching services have to be improved, with most current polls having been established through informal arrangements. Survey returns indicate that many auto drivers will not switch modes under any circumstances, based on work hours problems, locational difficulties, or other needs for the vehicle. Nevertheless, the NRC program has emerged as an important model of the potential trip reduction effectiveness of a well-designed and supported transportation management program.

Author's Note: This case study has borrowed extensively from a recent article: "Can Transportation Management Reduce Traffic in the Suburbs? Ask the Nuclear Regulatory Commission," which appeared in the November 1988 issue of Urban Land, published by the Urban Land Institute, Washington, D.C. Thanks are extended to Malcom D. Rivkin, principal of Rivkin Associates, Inc., Bethesda, Maryland, author of the article, and to Urban Land for permission to use major portions of the article to describe the NRC experience.

3. CASE STUDY: I-394 INTERIM HOV LANE

MINNEAPOLIS, MINNESOTA

1. SITE DESCRIPTION AND BACKGROUND

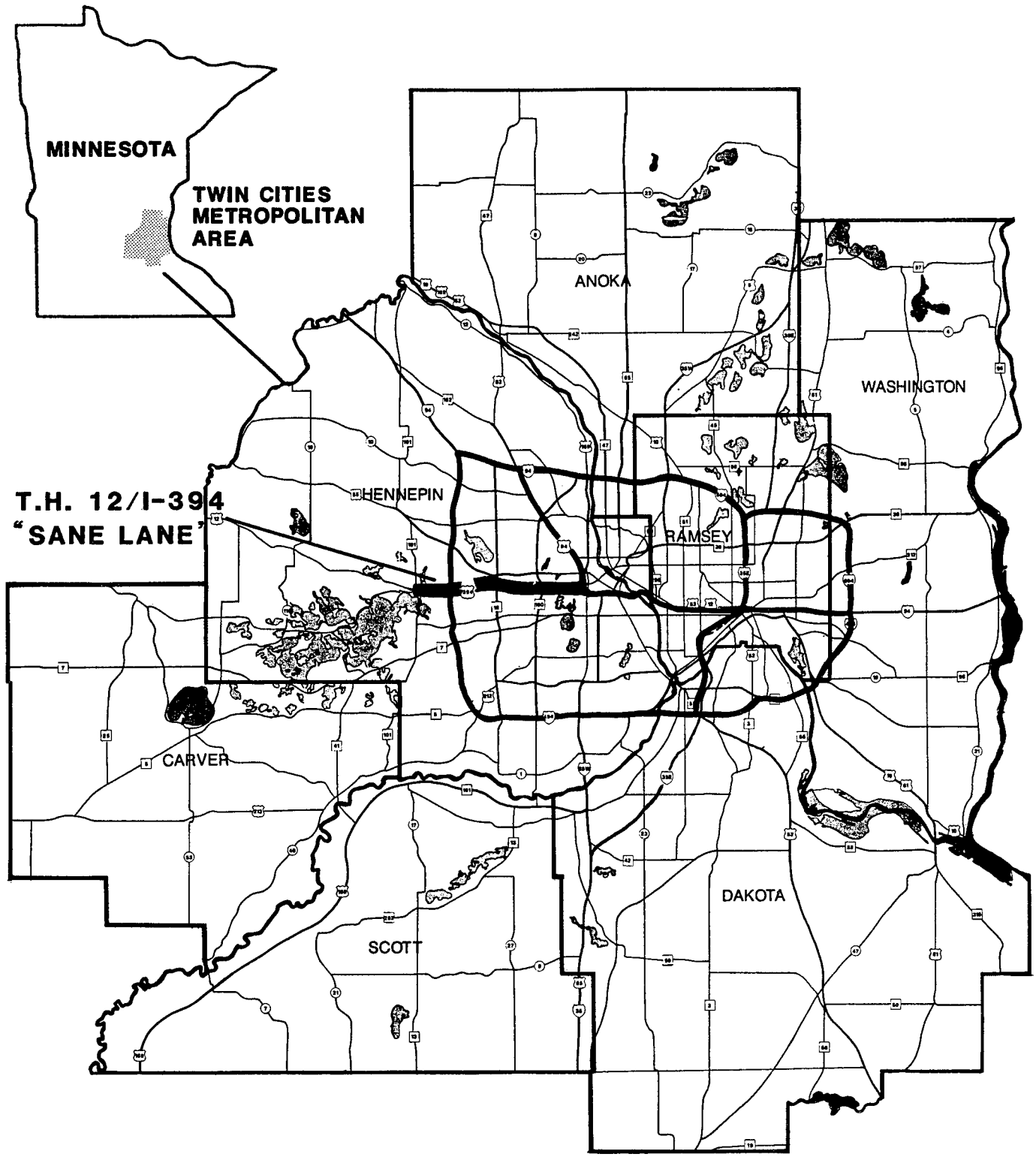
Trunk Highway 12 is a major artery in the Minneapolis-St. Paul highway system, connecting downtown Minneapolis with its western suburbs (see Figure 1). Highway 12 is a major commuting artery, providing an east-west linkage from circumferential highway I-494, and several north-south arterials, including Route 100, with both downtown Minneapolis and I-94 for travel to the eastern and southern parts of the Twin Cities area. Parallel facilities include Route 55, approximately 1 mile to the north, and Route 7, approximately 2 to 3 miles to the south.

As early as 1968, T.H. 12 was designated to be added to the Interstate System as I-394. However, after years of public controversy over the alignment of the proposed highway, the Minnesota State Legislature passed legislation in 1975 requiring that the new highway be built along the existing T.H. 12 alignment and that it have no more than 6 through lanes. After extensive review of design alternatives to accommodate this decision, the Twin Cities Metropolitan Council adopted the design concept of a 6-lane freeway with the two inside lanes reserved for buses, carpools and vanpools. These plans were approved by the state and the FHWA and final design and planning began in 1982.

In 1983, the Minnesota Department of Transportation (MnDOT) decided to prepare a Transportation System Management Plan to coordinate all of the program activities that would be necessary to support the construction and operation of HOV lanes along I-394. At about the same time, Minnesota Rideshare conducted a market research survey to assess the potential for ridesharing in the corridor, and to investigate the types of incentives which might be effective in encouraging HOV travel. One of the strategies recommended by that study was the construction of an "interim" HOV lane along Highway 12 for use before and during construction of I-394. A Corridor Management Team, formed to guide development of the TSM plan, adopted the interim lane concept, as a way of alleviating congestion impacts during construction, and conditioning behavior to ease implementation of the ultimate facility. MnDOT commissioned a design and the lane was built in 1985, with the first day of service on November 19, 1985.

2. CHARACTERISTICS OF PROJECT AND SUPPORTING PROGRAM

The I-394 interim HOV lane operates as a single reversible lane in the median of Highway 12, which is a 4-lane facility. The segment over which the HOV lane treatment extends, from I-494 east into the city, is only about 7 miles long. The HOV lane itself covers only a portion of this stretch of Highway 12, as shown by Figure 2, and is in two segments. The first segment is about 1 mile long, and extends from roughly the intersection with I-494 to Ridgedale Drive, at which point HOV users must merge back into regular traffic. Mixed traffic conditions prevail for approximately 2 miles until the next HOV segment, which

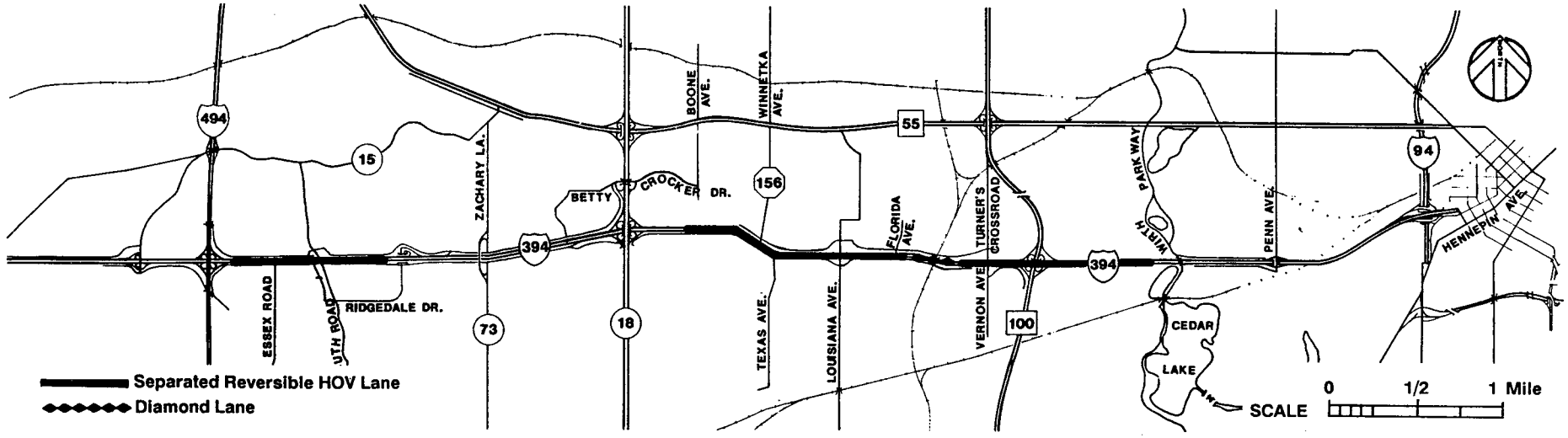


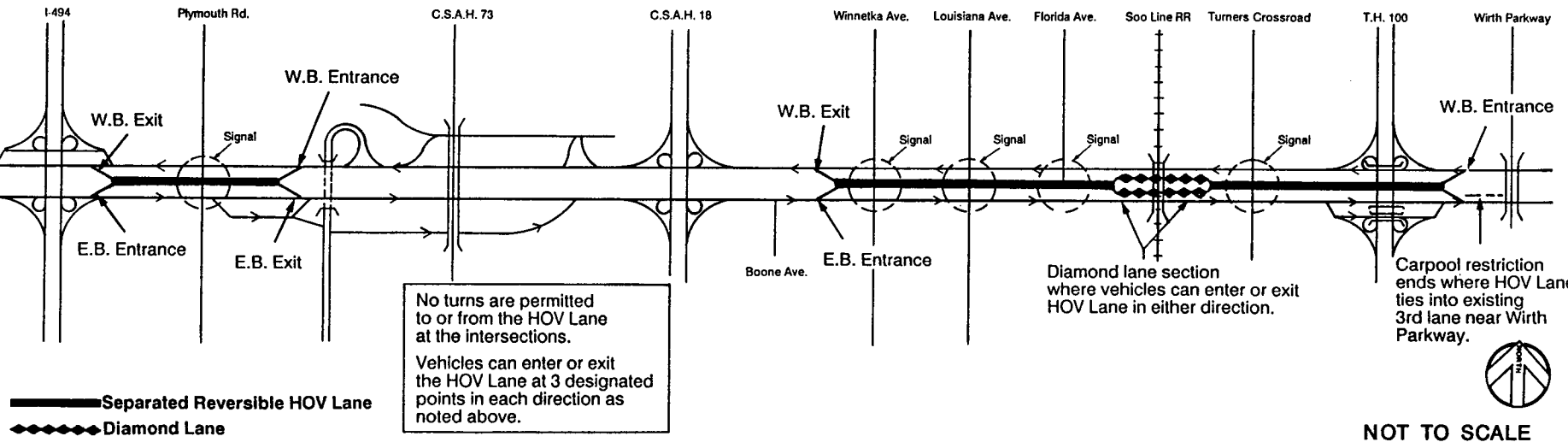
STRGAR-ROSCOE-FAUSCH, INC.

FIGURE 1

LOCATION OF I-394 INTERIM HOV LANE IN TWIN CITIES REGION

I-394 CASE STUDY FIGURE 1





STRGAR-ROSCOE-FAUSCH, INC.

FIGURE 2
LOCATION AND SCHEMATIC DESIGN OF THE T.H. 12/I-394 INTERIM HOV LANE

I-394 CASE STUDY

begins before Winnetka Avenue and runs approximately 3 miles to Wirth Parkway, just east of Highway 100, but still approximately 3 miles from downtown Minneapolis. A short section of this particular segment of the HOV lane splits into two narrow "diamond lanes" to squeeze under an existing railroad bridge. The segmented design of the interim lane is intended to provide continuity between segments of the proposed permanent I-394 HOV lanes as they are constructed. Travel within the two HOV lane segments is not non-stop; there is one signalized intersection within the first segment and four signalized intersections within the second segment.

Use of the lane is open to travelers in carpools or vanpools with at least 2 passengers, and to transit riders. Hours of operation of the lane are between 6:00 to 10:00 A.M., and from 2:00 to 7:00 P.M.

Concurrent with the introduction of the lane, a number of other important supportive activities occurred:

- Minnesota Rideshare opened a 251-space parking lot in downtown Minneapolis in November 1985 in conjunction with the opening of the HOV lane, and offered free parking for registered carpools. In June 1986, another lot with 320 spaces was made available.

- In December 1985, the public bus service along the Highway 12 corridor was reorganized. This included introduction of a new Route 75, which is an express peak period service making only one stop and running every 15 to 30 minutes, as well as provision of a timed-transfer option between the express service and a local service (Route 51).

- The capacity of one of the six existing park/ride lots (C.S.A.H. 73) along Highway 12 was increased by 60 spaces.

- Minnesota Rideshare launched a comprehensive marketing and outreach program within the corridor.

- The State Highway Patrol increased its enforcement activities along the corridor, and instituted a new schedule of fines for violations of the HOV lane, consisting of $44 for a first violation, subsequent fines of up to $100, and, if three violations are committed within two years, a court appearance and license review with possible suspension of license.

- A very aggressive public information/relations effort was undertaken prior to the opening and during the first year of operation of the HOV lane.

3. OVERALL EFFECTS OF PROGRAM

Overall, the HOV lane has apparently worked well and as expected. Despite the discontinuous segmentation of the lane, plus the signalized intersections, measured time savings for carpoolers using the lane average 8 minutes. Survey findings suggests that

carpoolers perceive an average savings of 10 minutes. Bus riders perceive a time savings of about 15 minutes. Bad weather greatly increases the time savings for all users.

Operationally, it was found that signal coordination is critical to maintaining travel time savings in the HOV lane. Signal phasing needs to be checked periodically and has been adjusted several times since the lane was opened. Also, it was initially anticipated that weaving in and out of the mixed traffic lane at the short diamond lane section might be a problem. In practice, this does not occur frequently, perhaps because this section is quite short and visibly connects two separated sections. The standard merges to and from the HOV lane are left merges which can pose operational problems in some situations, particularly when traffic volumes are heavy. Some extension of merge lanes was made to ease merging problems.

How effective has the HOV lane been in achieving its primary purposes, in terms of encouraging travelers to use HOV modes and in managing traffic congestion on T.H. 12 during reconstruction?

A local consultant, Strgar-Roscoe-Fausch, Inc., responsible for the engineering design of I-394, was also charged with monitoring the performance of the interim HOV lane during the first year of its operation. Several data collections were performed to conduct this evaluation. These included: daily traffic counts at three locations; an HOV lane use survey; bus ridership checks; auto occupancy counts; and travel time studies. Several analyses were possible with these data, as described below:

Recognizing that the morning peak hour represents the maximum hourly volume on Highway 12, the consultant's evaluation data were compiled for the AM peak hour only. Data collected in May 1984 have been used to represent pre-lane conditions, and data from October 1986 to reflect conditions approximately 1 year after implementation.

Two important changes occurred simultaneously with the introduction of the HOV lane on T.H. 12. These are illustrated in Table 1. First, travelers did respond to the availability of the lane and the broader program incentives of free parking, etc. to greatly reduce the rate of single-occupant vehicle usage. However, at the same time, the addition of the HOV lane on T.H. 12 as net additional capacity, plus the HOV time savings incentive, combined to attract travelers from other parallel routes and increase overall travel volumes. So there was both a significant change in modal split as well as a considerable increase in vehicular traffic. Overall, the change in modal split was the stronger effect, with the result that person trips on the facility greatly increased.

Prior to the interim HOV lane on T.H. 12, 61.9% of all persons traveled by single occupant vehicle, 20.1% rode in carpools or vanpools, and 17.9% rode transit. After opening of the lane, the percentage of people driving dropped over 13 percentage points, to 48.7%, while the number traveling in carpools or vanpools rose over 12 percentage points, to 32.8%. The percent of people riding transit remained about the same, at 18.5%, but the net increase in people using T.H. 12 also meant an absolute increase in one-way daily bus person trips of 190. Interestingly, the new ridesharing users seem to have come, percentage wise, from single occupant autos, allaying some conventional fears that HOV lanes will shift travelers primarily from high occupancy buses to lower occupancy carpools.

TABLE 1

SUMMARY OF TRAVEL IMPACTS

I-394 INTERIM HOV LANE
(AM PEAK HOUR)

	Before Lane May 1984	After Lane October 1986	Net Change
Travel Mode			
Drive Alone	61.9%	48.7%	-13.2%
Rideshare	20.2	32.8	+12.6%
Transit	17.9	18.4	+0.5%
Total Person Trips	2680	3630	+950 trips (35.4%)
Total Vehicle Trips	1946	2387	+441 trips (22.6%)
Average Vehicle Occupancy	1.17	1.29	+0.12 (10.3%)
Vehicle Trips per 100 Travelers	72.6	65.8	- 6.8 trips (9.4%)

Exactly why this change happened is not clear; the downtown free parking program certainly provided specific new incentives to carpoolers in addition to the HOV time savings. Transit riders also benefited from HOV time savings, and also modest improvements were made to transit service on T.H. 12.

The new mode split meant an increase in average vehicle occupancy from 1.17 to 1.29. Using an alternative measure, vehicle trips per 100 travelers, the travelers in the new system are generating 65.8 vehicle trips per 100 employees, compared to 72.6 per 100 before the lane and related programs. This means a reduction of 6.8 vehicle trips per 100 travelers. If the number of persons using T.H. 12 in 1986 traveled at the modal split rate seen in 1984, they would have produced:

3630 person trips x 6.8 veh.tr./100 = 247

additional vehicle trips per hour than the 2387 vehicle trips realized, or about 10.3% less than would have occurred.

The survey data permit exploration of the various shifts in travel among modes and routes that occurred when the Interim HOV lane on T.H. 12 was opened. Table 2 provides a breakdown of the prior mode and route of 1610 peak hour HOV lane users.

What these data illustrate is the high rate of behavioral change that occurred with the offering of the HOV lane. To better understand the display, first segment the HOV users into two primary markets: rideshare and transit. Of the 1610 surveyed HOV users, 64.5% are carpoolers and 31.7% are transit. Looking at the carpooler segment, only 25.3% (16.3% overall) were formerly carpoolers on T.H. 12; the great majority, 74.7% (48.3% overall), previously traveled on other modes and/or other facilities. Specifically, about half of the converted carpoolers, 50.5%, were formerly drive alones (15.9% on other routes); 35.4% were carpoolers on other routes; and 14.1% were transit riders (4.1% on other routes).

Among bus riders, about 38% were riders on non-public transit buses, for which the source survey data have no information on changes. Of the 62% who were public transit riders, only a small fraction were new riders. Only 13% of all public transit riders were new riders, and about two-thirds of these were previously drive-alones, while the remaining one-third were carpoolers. In summary, the significant shifts were from other modes to carpooling, and the most significant shift was from drive alone to carpool. And most new carpools were formed from previous T.H. 12 drivers.

TABLE 2

PRIOR MODE AND ROUTE OF INTERIM HOV LANE USERS

Travel Mode	Number	Percent
Carpoolers	**1039**	**64.5%**
Previous Carpoolers, T.H.12	262	16.3%
Diverted	777	48.3%
Drive Alones	392	24.4%
T.H. 12	*268*	*16.7%*
Other Routes	*124*	*7.7%*
Carpoolers, Other Routes	275	17.1%
Transit Riders	110	6.8%
T.H. 12	*78*	*4.9%*
Other Routes	*32*	*2.0%*
Transit Users	**510**	**31.7%**
Public Transit	319	19.8%
Previous Users	277	17.2%
Diverted Users	42	2.6%
Drive Alones	*27*	*1.7%*
Carpoolers	*15*	*0.9%*
Other Bus	191	11.9%
Total	**1610**	**100.0%**

4. CASE STUDY: MINNESOTA RIDESHARE FREE PARKING PROGRAM

MINNEAPOLIS, MINNESOTA

Commuters to the City of Minneapolis are provided a special incentive to consider ridesharing as their method of travel. Minnesota Rideshare, an agency within the Minnesota Department of Transportation, offers registered carpoolers and vanpoolers free parking privileges at a group of downtown fringe lots. Since its introduction in 1983, the program has drawn an steadily increasing number of users, closely tracking the supply of spaces that the program is able to offer.

The program was initiated primarily as a construction impact mitigation strategy. Plans to convert Highway 12, a major arterial serving downtown Minneapolis from the west, into an interstate highway (I-394) meant that highway capacity in that corridor would be reduced for some time. It was reasoned that increasing HOV usage during the reconstruction period, scheduled to last between 1985 and 1992, might help minimize congestion for commuters. The free lots, which are located on the western fringe of the downtown, were part of a two-fold strategy that also included implementation of an HOV reserved lane on Highway 12/I-394. The free lot/reserved lane program will also be part of the new highway when it is completed. I-394 will feature a permanent HOV express lane, and three parking garages will be constructed at the downtown terminus of I-394 along Third Avenue which will feature priority parking and direct HOV entrance ramps from the freeway.

Figure 1 illustrates the location of the special lots within downtown Minneapolis. There are currently six facilities. Locations numbered 1 through 5 are surface lots located on land owned by the Minnesota Department of Transportation, and parking at these lots is free. Facility 6 is a privately-owned lot which is located in an area where parking is highly desirable. Minnesota Rideshare has struck a deal with the lot owner to offer a reduced rate for pools, charging them $37 per month instead of the standard $47 per month. Facility 7 is the only structure parking facility. It is one of the previously described distributor garages for I-394, and is expected to open in August of 1989. Rates at this garage will be $10 per month for I-394 carpoolers and $80 per month for all others.
All of those facilities which are owned by the Minnesota Department of Transportation are maintained and managed by the City of Minneapolis. While the lots are located at the fringe of the downtown, access is facilitated by MTC Dime Zone bus service from most of the lots and by vanpool loading areas at numerous locations within the center of town. By parking in the free lots, users save between $30 and $80 per month in parking costs relative to comparable locations, and between $100 to $200 for parking in the downtown core.

To be eligible to use the lots, carpoolers must register with Minnesota Rideshare and receive a permit. A sample of the registration form is shown in Figure 2. To qualify as a carpool, the unit must have at least two members, they must carpool at least three days a week, and the destinations of the passengers must be within a three-mile radius of downtown Minneapolis.

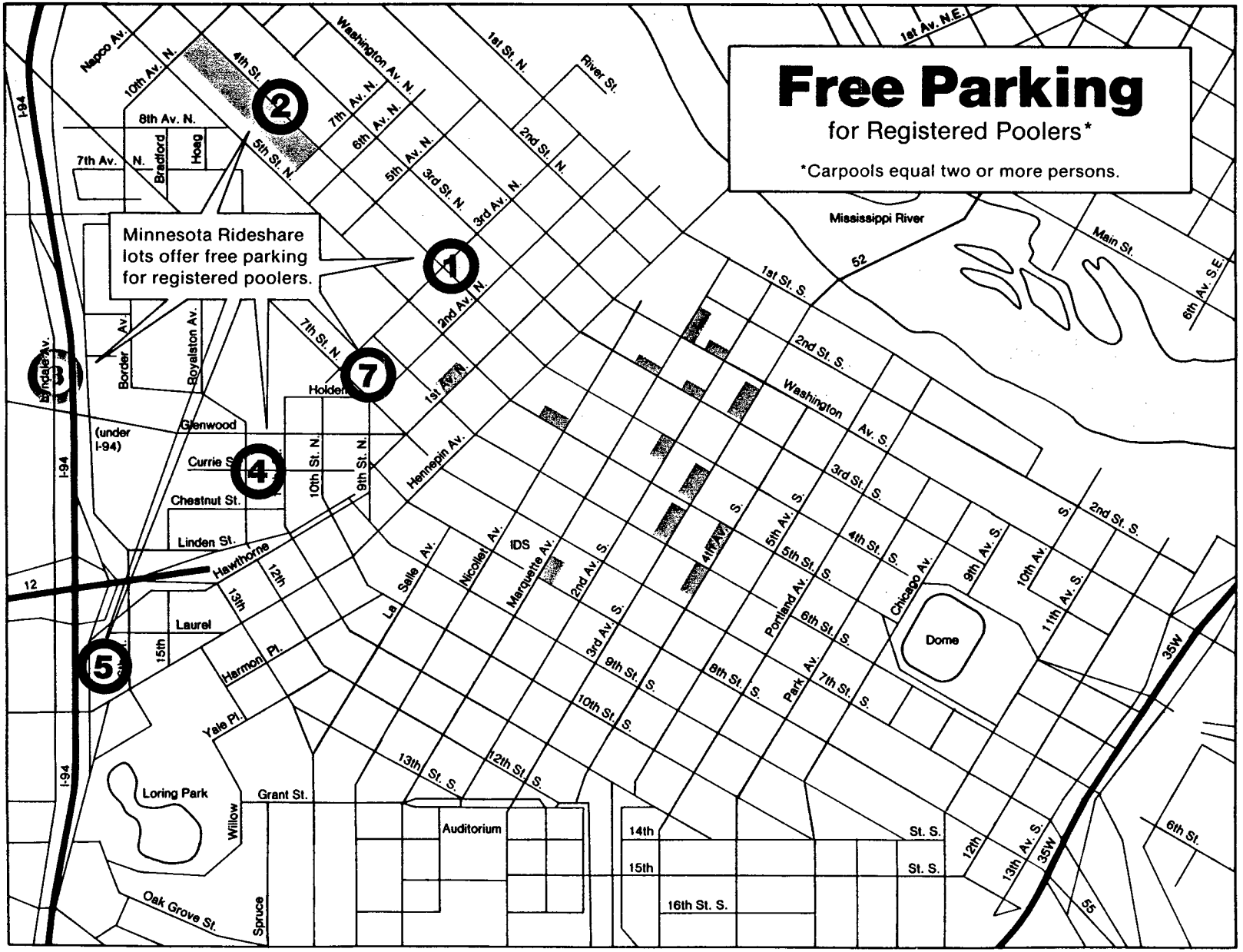


FIGURE 1

LOCATION OF CARPOOL LOTS

SAMPLE

MINNESOTA RIDESHARE

METROPOLITAN TRANSIT COMMISSION
560-6th Avenue North, Minneapolis, Minnesota 55411-4398 612/349-RIDE (7433)

MINNEAPOLIS: AFFIDAVIT/REGISTER
PERMIT PARKING PROGRAM

SAMPLE

POOL # CP 1000
(For Office Use Only)

AFFIDAVIT, this 8th day of August, 1988, does hereby state and affirm: I, Joe Smith and Bill Jones and _____ are participants in a 2 or more person car or vanpool, regularly (three or more days per week). PLEASE PRINT THE FOLLOWING INFORMATION FOR EACH POOL MEMBER COMPLETELY.

ID# (OFFICE USE ONLY)	NAME HOME STREET ADDRESS CITY, ZIP CODE	WORK PHONE # HOME PHONE #	COMPANY NAME & WORK HOURS	YEAR, MAKE, MODEL LICENSE PLATE # (TO BE USED IN POOL)
	1. Joe Smith	337-0000	Daytons	'82 Ford ESCORT
	4000-1st Ave So #1	922-0000	8:00-4:30	PPP-111
	Mpls. 55400			
59	2. Bill Jones	349-0000	1st Banks	84 CHEV Monte
	3200 Blaisdell Ave So.	925-0001	8:15-4:45	Carlo BBB-111
	Mpls. 55400			
	3.			

Further, we understand that privileges for free parking will be **revoked** if regular ridership falls below the required 2 persons and/or usage falls below three days per week.

SIGNED Joe Smith DATE 8-8-88
Bill Jones

WITNESS C. Lee DATE 8/8/88

WE REQUIRE THAT ALL POOL PARTICIPANTS SIGN THIS AFFIDAVIT. Please mail the commuter application cards and this affidavit together to our office. You will be required to re-register every 6 months.

FIGURE 2

SAMPLE CARPOOL REGISTRATION FORM

Each pool must reregister every six months. Registered pools are issued a parking permit which hangs from the rear-view mirror. The permit is meant to be transferable, to allow for alternate use of different pool member's vehicles. The program is not heavily enforced, but periodic checks of proper use of permits is made. The principal enforcement is against non-registered use of the lots; towing is actively administered by the City of Minneapolis.

Since inauguration of the program in 1983, the network of lots and the supply of spaces has changed in response to construction activity and other factors. As shown below, the program began with only two lots and 189 spaces, for which registered units quickly reached 144. Lot capacity reached a maximum in 1986/87, with five lots supplying 1699 spaces. Usage reached a maximum in 1987, with 1356 registered pools. Lot capacity fell in 1988 due to some shifting in facilities; the number of spaces has been reduced to 1378, and availability appears to have had an effect on usage, as the number of registered pools has dropped to 1207. When the 5th Street garage is completed in August, capacity will increase again, as presumably will registrations and usage.

Year	Number Lots	Number Spaces	Number Users
1983	2	189	40
1984	2	189	144
1985	5	1389	566
1986	5	1699	1206
1987	5	1699	1356
1988	5	1378	1207

While Minnesota Rideshare has never done a formal occupancy count at the free lots, an informal assessment of the effectiveness of the program can be made by looking at the registration data. The 1207 pools registered in December 1988 claimed 2752 named riders. If each of these named passengers actually rode in the registered pool, this travel would correspond to an average occupancy of 2.28 persons per vehicle. If each of these people formerly drove alone to work downtown, then the program could be credited with saving 2752 - 1207 = 1542 vehicle trips into downtown Minneapolis every peak period, which would be a substantial trip reduction.

In actuality, the gains attributable to the Free Parking program cannot be counted so simply. Not all of these people rideshare 5 days a week, and not all of them were converted to carpooling by the free parking program. Some may have carpooled or taken transit before, while others may have resorted to carpooling for reasons other than the free parking program, in particular the availability of the reserved HOV lane for Highway 12 travelers.

To try to separate these various effects and arrive at an estimate of the net effect of the Free Parking program, Minnesota Ridesharing staff conducted a survey of registrants in January 1989. The survey was mailed to 2752 registrants, and asked questions about current commute method as well as behavior before joining the free parking program. The

survey was also structured to ascertain the location/direction and route of the registrant's trip, plus demographic information. 1172 usable responses to the survey were received. Responses to relevant questions from the survey are displayed in Table 1. It will be noted that the responses are separated into two groups: Persons whose route of travel is Highway 12 (I-394), where the HOV lane provides an added inducement to carpooling; and for the entire sample, which includes Highway 12. Highway 12 users account for about 14% of the total sample.

The data in Table 1 suggest some conflicting results when trying to assess the overall effectiveness of the parking program. Looking first at the change in mode reflected in the listing of previous mode of travel, it is clear that the program had an effect on choice of mode. Before becoming registered carpoolers or vanpoolers, about 35% of all respondents formerly drove alone. All of these people were converted to ridesharing arrangements. However, almost as large a percentage of carpoolers were formerly transit riders; on Highway 12, 27.5% formerly rode the bus (with and without auto access), as did 29.3% of the overall sample.

The change in occupancy can be estimated in the following manner. For current registrants, the survey estimates that the average number of occupants is 2.4 per vehicle on Highway 12 and 2.57 overall. However, not all of these arrangements pool together every day. The average for both cases is about 4.7 days per week. If a "discount" factor of 4.7/5.0 is applied to the reported occupancy, an "effective daily" occupancy of 2.26 for Highway 12 users and 2.43 for the overall sample is calculated.

To estimate the average occupancy of the same group of travelers before joining the program, the percentages in the modal distribution are divided by the following modal occupancy rates:

Drive Alone = 1 occupant
Carpool = 2.26 and 2.43 (assume same as present)
Vanpool = 12 occupants
Bus = 30 occupants
Other = assume no vehicle trip

Under these assumptions, Highway 12 users are judged to make 45.6 vehicle trips per 100 travelers, equating to an average occupancy rate of 2.19. The overall sample would have made about 48 vehicle trips per 100, equating to an occupancy level of 2.06.

Comparing the overall sample before and after participation in the program suggests that a moderate trip reduction can be tied to the program. Assuming 2752 registered users formerly traveled in a combination of modes averaging 2.05 persons per vehicle trip, that implies 1336 vehicle trips. Under the new occupancy of 2.43, vehicle trips are reduced to 1133, suggesting a savings of 203 trips against a base of 1336, or a net trip reduction of about 15%.

In the case of the Highway 12 users, the number of registered users who would use this route is estimated as 14% x 2752 registrants, or 385. The number of vehicle trips that this sample would have formerly generated at an occupancy rate of 2.19 would be 176; under the new occupancy of

TABLE 1

SUMMARY OF RESPONSES TO JANUARY 1989 SURVEY OF PROGRAM REGISTRANTS

	Primary Route of Travel	
	Highway 12	**All**
Previous Mode of Travel		
Drive Alone	35.6%	35.4%
Carpool	31.9	31.1
Vanpool	-	1.5
Bus	20.0	21.2
Drive + Bus	7.5	8.1
Other	5.0	2.7
Estimated Average Occupancy	2.19	2.06
Current Number of Occupants	2.40	2.57
Current Avg. No. Days Carpool	4.70	4.74
Effective Occupancy per Day	2.26	2.43
Monthly Parking Cost Before	$62.60	$55.45
Travel Time After	31.6 min	31.4 min
Did Free Parking Encourage You To Carpool?		
Pct. "Yes"	90.7%	92.1%
Average Age of Current Pool	21.7 mos.	21.5 mos.

TABLE 1 (Continued)

Reasons for Carpooling	
Money Savings	18.4%
Convenience	15.9
Time Savings	13.4
Reliability	12.0
Avoidance of Stress	10.5
Bus Unavailable	8.7
Changed Job Location	7.4
Do Not Drive	7.0
No Car Available	6.9

2.26, 170 vehicle trips are generated, implying a net savings of 6 trips, or 3.5%, among Highway 12 travelers.

The conclusions from this analysis are that (1) the Free Parking certainly caused changes in mode choice behavior, however, (2) without comparable incentives to support other high occupancy modes, i.e. transit in this case, comparative advantages in using carpools may make them the favorite choice and thereby minimize the overall trip reduction potential.

There is no obvious reason why the rate of reduction should be so much less for the Highway 12 contingent of Free Parking users than the other areas, except that there were slightly higher rates of transit use on Highway 12 before the program, and the occupancy levels of carpools formed by highway 12 users are lower than the sample average. Both the carpool and transit users of the HOV lane realized comparable net travel time savings. Demographically, the Highway 12 travelers have some slight differences from the sample as a whole. A somewhat higher percentage of them are Professionals (57% vs 43%), a higher percentage are males (51.2% vs 47.9%), and incomes are slightly higher ($42k vs $39k). However, in terms of household size, number of workers, and vehicle ownership, they are fairly similar.

The cost savings offered by the free parking program seems to have had a direct effect on the decision to carpool. When asked directly whether the free parking program encouraged them to carpool, 92.1% of the sampled users said "yes", as did 90.7% of the Highway 12 users. The average monthly parking savings was about $55 for the average user, and about $63 for the Highway 12 user.

From a list of possible factors suggesting reasons for carpooling, money savings was the most frequently cited reason, followed by convenience, time savings, reliability, avoidance of stress, non-availablity of a bus, change in job location, non-ability to drive, and non-availability of a car. Pools formed under the program have had reasonable longevity. The average age of pools registered into the free parking program is 21.5 months -- almost 2 years. Minnesota Rideshare believes that the rate of attrition of pools out of the program is on the order of 10%.

In conclusion, the concept of offering free parking to carpoolers as an economic incentive to rideshare has shown a demonstrated capability to reduce trips. Important questions to be weighed in considering application of this concept on a larger scale or in other locations are:

- What is the cost for such a program, including the effective cost of the land, the administrative cost, and also the revenue cost of forfeiting the parking or other revenues which could be generated by the land?

- How many vehicle trips will be reduced as a result of the program? If the program runs in competition to existing transit service, the effect of the comparative advantage in diverting travelers from transit to carpools can be counterproductive to trip reduction goals.

5. CASE STUDY: 3M COMPANY

ST. PAUL, MINNESOTA

1. SITE DESCRIPTION

The 3M Center is the international headquarters of the 3M Company, which operates one of the oldest and most successful private Travel Demand Management programs in the United States.

The center is located in the eastern suburban portion of the Minneapolis-St. Paul metropolitan area, and occupies approximately 420 acres in a campus-type setting. Both laboratory and administrative facilities are located on the site, which employs nearly 13,000 people in a complex of 24 buildings, comprising over 10 million square feet. Figure 1 illustrates the location of 3M Center relative to the metropolitan area, while Figure 2 highlights the layout of the Center itself.

The area in which 3M is located is quite low in density, being at the eastern fringe of the urbanized area. Access to the site is primarily by Interstate highway.

I-94 forms the southern boundary for the center. McKnight Road and Highway 120 (Century Avenue) form the eastern and western boundaries, and each has direct access via interchange with the interstate. In addition, there are several slip ramps that allow easy access directly into and out of the center to the interstate. A short distance to the east is I-694, a circumferential freeway that connects with areas north and south of St. Paul.

2. BACKGROUND AND MOTIVATION FOR TDM PROGRAM

3M's first building at the Center was built in the early 1950's. Since that time, the site has experienced steady growth to its current capacity of 24 buildings. From the beginning, as the company's growth trends became evident, 3M conducted studies of its employees' travel behavior to try to forecast future traffic levels and estimate transportation and parking needs.

By 1970, it had become clear that trends in employee travel would eventually limit the company's ability to grow at the 3M Center site. A Home-Work Survey conducted in 1970 showed an average vehicle occupancy of 1.24 persons, confirming a heavy reliance on single-occupant vehicle travel. Only one bus line from downtown St. Paul provided transit service to the Center, and the total bus ridership out of 7700 employees numbered only 43. The company realized that it had to become actively involved in the management of its employees' transportation if it was going to realize its growth potential at the site.

Several employee transportation programs were considered, and with the approval of management in 1971, the company began implementation of the following measures:

FIGURE 1

REGIONAL LOCATION OF 3M CENTER

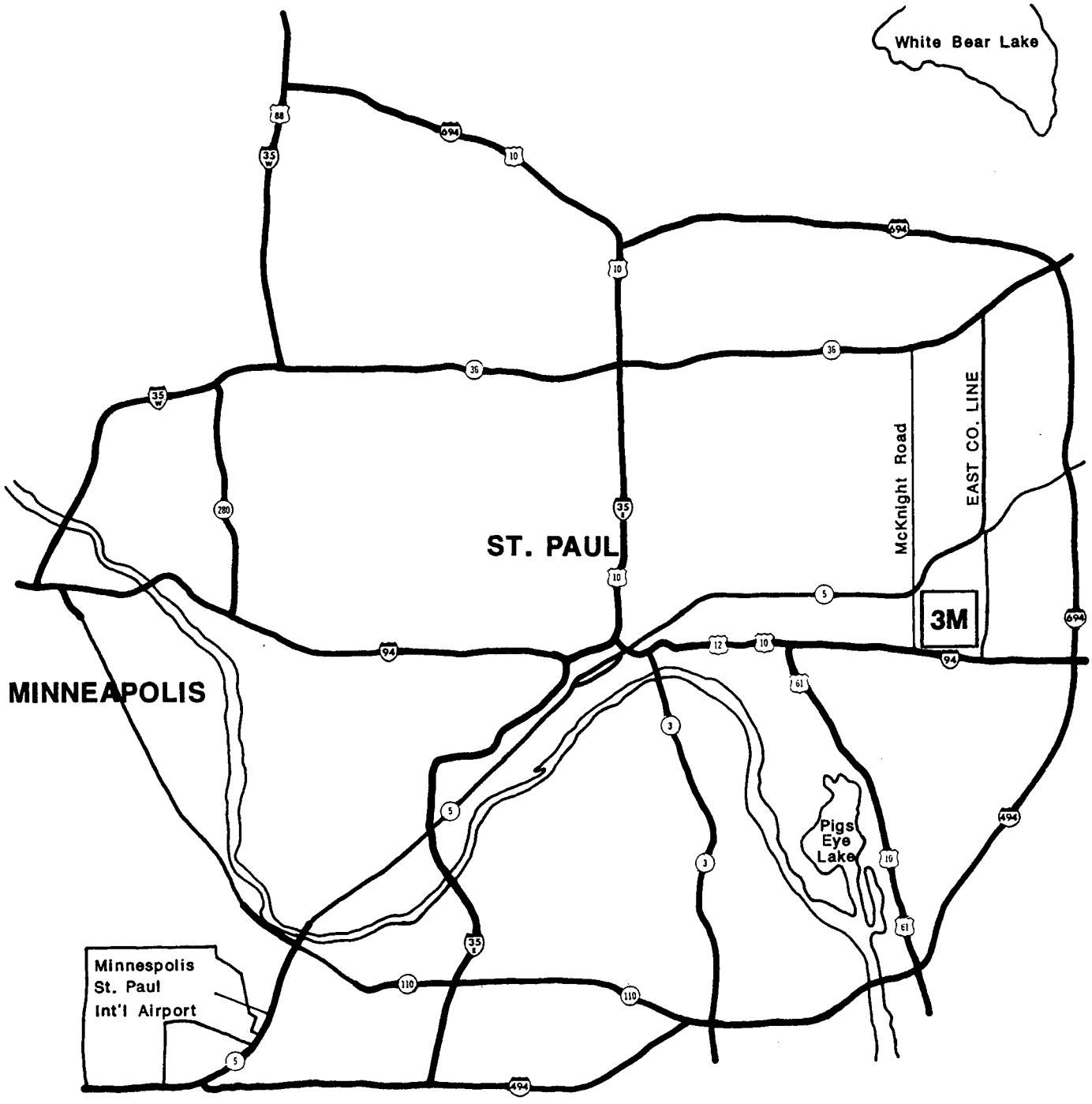
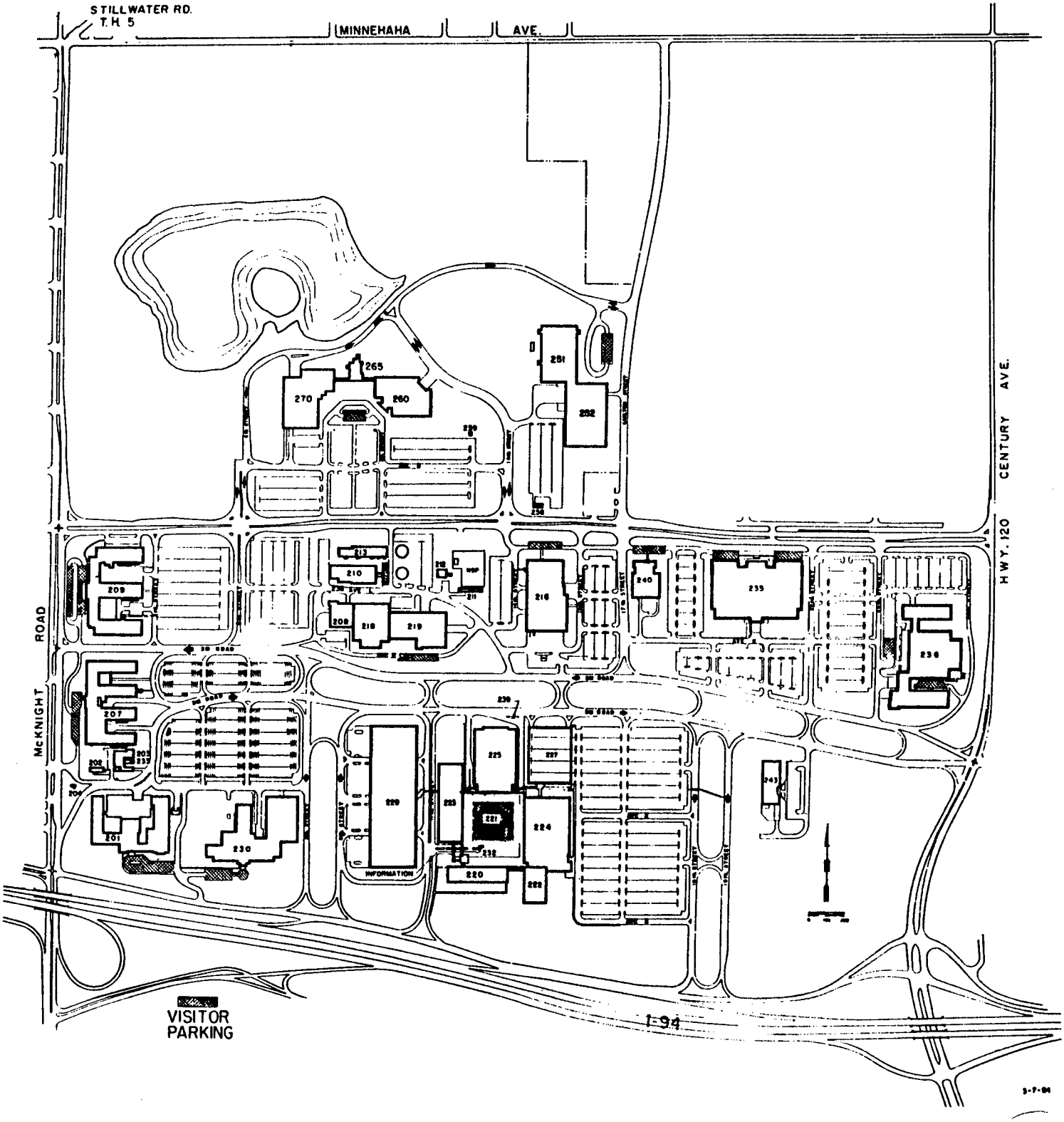


FIGURE 2

SITE MAP OF 3M CENTER



- o Staggered work hours
- o Subscription buses
- o "Ride-Guide" (carpooling program)
- o "Commute-A-Van" (vanpooling program)
- o Safety and capacity improvements

Listed below is a summary of the principal program initiatives.

Staggered Work Hours

One of the first measures instituted by 3M was a staggered work hours policy, designed to provide immediate relief to serious peak hour traffic at the site and on the major transportation facilities leading to the site. Prior to 1971, all activities at the 3M Center site were conducted during an 8 to 5 workday. This meant that over 7000 people were trying to reach the site within the span of an hour. A decision was made to stagger the starting times of the two employee populations with the most separable functions -- the administrative and the lab employees, which each comprised about 50% of the workforce. In 1971, new work hours were instituted for these groups, with the administrative employees asked to work a 7:45 to 4:30 day and the lab employees asked to work an 8:15 to 5:00 day. The effect on reducing peak hour traffic was immediate, and helped win upper management support for future transportation program initiatives.

In November 1988, the company introduced a true flextime policy, which it calls "personalized work schedules". It allows employees to work with their departmental managers to reach a mutually agreeable arrival and departure time. The only requirement is that the employee work a minimum of 8 hours a day, and be on-site between the hours of 9:00 AM and 3:00 PM. Utilization of the new policy has thus far been limited.

Subscription Bus Program

3M recognized that usage of transit service to the site was greatly limited by the nature of its location, and that only one existing bus route provided service. It also realized that if employees were to be expected to use transit, the service would have to be reasonably direct and efficient. This gave way to the idea that special transit services might be designed to serve segments of the employee population that lived in concentrations some distance from the Center.

An experimental service was initiated in January 1982, with a single bus providing subscription service between the Center and a suburban area approximately 12 miles north of the Center. At the time, about 780 employees lived in this particular suburban area and commuted to work at the Center. The design of the "subscription" service was to pick up 3M employees near their homes on an established schedule, and transport them direct, non-stop to the Center.

3M contracted with the Twin Cities Metropolitan Transit Commission (MTC) to provide the service. The contract allowed for equal sharing of any operating losses between MTC and 3M, so in effect 3M was guaranteeing reasonable usage. Three fare options were offered to riders: a 10-ride punch ticket, an unlimited monthly pass, or simple cash fare. Although the service was implicitly subsidized through the 3M contract guarantee, employees were offered no direct fare subsidy to use the service.

The initial service comprised one bus trip each day, and carried only 10 to 12 passengers, but soon grew to an average of 42 passengers and a second bus was added. 3M continued to experiment with subscription services to other areas, reaching an agreement with MTC that the agency would assume full responsibility for the service once ridership reached 75% of the vehicle's seating capacity. Continued development of subscription arrangements lead to a maximum ridership of about 250 employees.

As of the early 1980's, however, with federal spending cutbacks greatly reducing subsidy allowances to public transit agencies, the ability of the MTC to continue to provide such service to 3M was significantly altered. Based on the modest ridership and the conclusion that it was difficult to find sufficient concentrations of employees to provide an adequate base of riders to support a 47- passenger bus, 3M reduced its interest in expanding this program.

"Ride-Guide" Carpooling Program

The carpool program at 3M is somewhat different from many contemporary programs in that it places most of the initiative for identification and formation of pool arrangements in the hands of the employee. The company posts maps in common areas where employees pass in large numbers, such as building entrances, vending machine lobbies and cafeterias. Numbered pins and sign-up sheets are placed beside the maps. Pin colors are used to designate whether a person is willing to function as a driver, passenger or both. Information on the sign-up sheet includes employee residence and 3M Center building address plus the driver/passenger preference, which is used to place the applicant's colored pin on the map. Employees are expected to check the maps and make the appropriate contacts themselves. Computer matching of potential carpool opportunities is done by request, but the number of such requests is said to be quite low, based on the success of the Ride-Guide.

In 1970, prior to introduction of the Ride-Guide system, carpooling at 3M was practiced by about 13% of all employees. In the period following both introduction of the program and the 1973-74 Arab Oil Embargo, the number of employees carpooling virtually doubled, reaching a percentage of over 20%. Since that time, the number of employees carpooling has declined somewhat, while the company itself has grown, causing the share to decline to the level of about 14%. With 1791 persons participating, the carpooling program is still the most successful of all the company's transportation programs in terms of size.

Vanpool Program

Despite the number of 3M employees participating in the carpool program, 3M is most

proud of its vanpool program known as "Commute-A-Van". While a smaller number of employees participate in the vanpool program, the effectiveness of the program in reducing vehicle trips to the 3M Center is the highest of all the company's TDM measures.

When 3M initiated its vanpool idea back in 1972, it was one of the first organizations to consider such a program. The idea grew out of a proposal prepared in May 1972 that lead to a small-scale demonstration of the concept in January 1973. Six pools were formed in the first demonstration, with the units targeted at communities identified through the 1970 employee survey.

The concept of a vanpool program developed by 3M was to provide an employee unit with a 12-passenger van, purchased and supplied by 3M. The operator of the van would be a permanent 3M employee, and would be known as the Pool Coordinator. A minimum of 9 passengers, excluding the driver, would be required to commission a van. The 9 passengers would be required to pay a monthly fare that would be set at such a level as to recover all fixed and operating costs associated with the van. The driver would not be expected to pay a fare, would be allowed personal use of the vehicle, and would be given all passenger fares beyond the 9-passenger threshold set to cover the costs of the van.

In operating the vanpool program, 3M wished to neither make a profit from the program or have it regarded as a subsidy to employees. To determine the fare structure, the purchase cost of the vehicle is depreciated over a 5-year period, with an assumed resale value at the end of the period. The operating costs are then added based on the round-trip miles per day for each pool. Obviously, monthly fares are higher for employees making longer trips.

While 3M does not directly subsidize the vanpool program, several cost advantages accrue to users. First, because 3M is self insured, the cost of insurance to operate the vanpool is quite modest. Second, the vans are maintained in 3M's shops. Third, administrative costs to run the program are not passed on to the vanpool. And finally, in some instances, individual departments have actually purchased the vans and turned them over to the pool as a charitable contribution. At the company level, the company also maintains a number of backup vehicles to cover downtime of the regular vans. 3M does not provide preferential parking for either its vanpool or carpool programs.

There are also other advantages that vanpool users experience. Pool drivers, of course, realize free transportation and potentially a small profit from additional passengers. They also have another vehicle for their personal use, which has allowed some to do with one less family car. Passengers enjoy the exclusive nature of the service: doorstep pickup, reasonable comfort, and no "outside" waiting. Some riders have indicated that they have been able to do without an additional family car. Most riders are particularly taken by the social integrity of their pooling unit, which tends to stay together for many years and maintain its social bonds outside the workplace.

Based on 1985 statistics, the program operates 105 vans; about half of these are 12-passenger vehicles and the remainder are 7-passenger. 991 employees are vanpool riders, which is about 7.8% of the current employment of 12,700. This is down considerably from the 135 vans (1210 passengers, or about 10.3% of total employment) that were in operation at the peak of the program in 1980, but still accounts for a significant number of users and

vehicle trips reduced. The average round trip for a van is 50 miles, and the average monthly user charge is $46. This fee breaks down to approximately 50% capital cost and 50% operating cost recovery.

The vanpool program's two key advantages over time have been net trip reduction and time stability. At 7 to 12 passengers per vehicle trip, the vanpools are 3 to 5 times more efficient in reducing vehicle trips than the average 2.5 passenger carpool. And while a transit vehicle can carry more passengers, it is not able to provide the same quality of door to door service, meaning that it will not be as heavily used. In terms of time stability, while usage of both carpools and vanpools has declined over time, vanpools have declined significantly less.

3. OVERALL EFFECTS OF PROGRAM

The 3M Company's efforts in providing commuting alternatives for its employees appears to have produced an appreciable vehicle trip reduction. The following table illustrates the impact over time of the company's efforts on employee behavior and trip reduction.

	1970	**1974**	**1977**	**1980**	**1985**
Employment	7723	9476	10,711	11,740	12,700
Method of Travel					
Drive Alone	91.6%	81.3%	82.0%	79.9%	82.7%
Carpool	13.0	20.1	14.0	14.8	14.1
Vanpool	0	6.0	8.7	10.3	7.8
Transit	0.6	1.2	1.7	1.8	1.7
Vehicle Trips per 100 Employees	91.6	81.3	82.0	79.9	82.7
Average Vehicle Occupancy	1.09	1.23	1.22	1.25	1.21

The number of vehicle trips per employee has been calculated using the following assumed occupancy rates: 2.5 persons per carpool unit; 12 persons per vanpool; and 30 persons per transit vehicle trip.

If the 3M situation in 1970 is taken as a measure of travel conditions in the absence of a TDM program, then the effectiveness of 3M's TDM program efforts in reducing trips can be gauged by comparing subsequent years against this 1970 base. The trip reduction attributed to the 3M program based on conditions in 1985 is calculated as follows:

Vehicle trips per 100 employees, 1970 = 91.6

Vehicle trips per 100 employees, 1985 = 82.7

Net trips reduced = 91.6 - 82.7 = 8.9 per 100

Total vehicle trips reduced = 12,700 x .089 = 1124

Percent reduction
due to program = {(12,700 x .916) - (12,700 x .827)/(12,700 x .916)} = 9.7%

Through this calculation, it can be inferred that the 3M program has caused its employees to alter their method of travel, to the extent that at its 1985 employment level of 12,700, 1124 fewer vehicle trips are made by private vehicle than would have been made under modal split conditions that existed in 1970.

Another measure of background conditions has been obtained from the Metropolitan Council, the regional planning agency for the Twin Cities. Data obtained from the Council's comprehensive transportation planning process were analyzed to approximate modal shares of travel to a suburban location, in this case the area along the I-494 corridor south of Minneapolis. The Council's data suggest a modal split to this I-494 area of 86.5% drive alone, 11.5% ridesharing, and 2% transit. Since the ridesharing to this area is predominately carpool, the vehicle trip production rate for this modal split is estimated as:

(86.5% DA/1) + (11.5% RS/2.5) + (2% TR/30) = 91.2 vehicle trips per 100 employees

This rate of vehicle trip generation compares very closely with conditions at 3M before the TDM program, and represents a good check on the background assumptions used to estimate the effectiveness of the 3M program.

Aside from the trip reduction, another finding is clear from the above data: the effectiveness of 3M's TDM program has been declining over time. Utilization rates of HOV modes reached a peak, along with vehicle occupancy, in 1980, and have gradually declined since then. Attrition has occurred in all HOV modes, although the company feels that the vanpool program has been the most stable, perhaps because its passenger unit seems to have its own stability. What the trends imply to the company is that, as economic

conditions improve, people will prefer to drive their own car. Without disincentives to driving at the workplace, commuters who can afford to drive will do so. Similar trends are evident at other sites whose program characteristics are like those at 3M.

Historically, 3M has not used its parking as a device for managing employee travel. There is adequate parking at the Center for anyone who wishes a space, and carpools or vanpools are not given preferential treatment. While the company is concerned about the cost of providing parking, and the competition of parking for other land uses, the economics to alter employee parking conditions have not been compelling. At 12,700 employees, 3M has reached a condition of stability at the St. Paul site; the company's corporate growth is now being directed to other geographic regions of the county. Therefore, the land currently devoted to parking is not presenting a major obstacle to growth of the Center as was once feared. Also, most parking at the Center is provided on surface lots, at a cost of only about $700 per space.

A new development at the Center may test the company's policy on the parking issue. A new central administration building is being planned for the Center that would be located in the Center of the campus where parking is likely to be restricted. The company would have to eliminate some existing parking facilities to construct the building, and addresses the new parking needs through structure parking, which could cost as much as $10,000 per space. 3M is carefully studying its options in this situation, to see what types of TDM strategies would allow it to build the building in light of the parking and cost constraints.

6. CASE STUDY: BELLEVUE, WASHINGTON

1. SITE DESCRIPTION

Bellevue, Washington is a suburban community located in eastern King Country, about 5 miles east of downtown Seattle. The City of Bellevue is the fourth largest city in the State of Washington, with a population of about 83,000. The Bellevue CBD is the second largest employment center in King County, ranking right behind Seattle. Over 24,000 people are employed in the CBD, of which approximately 14,500 are office employees. Figure 1 illustrates the location of Bellevue in the Seattle Metropolitan area.

Its land use patterns make Bellevue somewhat different from other suburban areas in King County, or elsewhere in the U.S., for that matter. The CBD, in particular, features densities and a street network more like a "traditional" downtown. Whereas most suburban employment centers are characterized by low-rise, campus-type office parks, downtown Bellevue presents an expanding skyline of high-rise buildings. Parking facilities are rather limited in the CBD, and most employee parking is priced.

Employment in the CBD is almost exclusively white-collar professional, with supporting retail and service industries. It is estimated that there are more than 300 different employers in downtown Bellevue. There are a few large employers, but most are small, located in large, multi-tenant buildings. The larger employers include US WEST Communications (formerly Pacific N.W. Bell, with approximately 1200 employees), Puget Power (approximately 840 employees), and PACCAR (about 450 employees). More characteristic are the small employers located in multi-tenant office buildings and retail businesses.

Residential areas adjoin the CBD, but workers come to Bellevue from throughout the region. As indicated by the map, the study area's location is well defined by the regional highway network. Interstate 405 flanks the area on its eastern boundary, and connections with Route 520 (2 miles to the north) and I-90 (3 miles to the south) link Bellevue with Seattle and the rest of the metropolitan area to the west across Lake Washington. These expressway facilities and the arterial system are congested with commuter traffic during the peak travel period.

2. BACKGROUND AND MOTIVATION FOR TDM PROGRAM

Bellevue's rapid growth and potential for serious traffic problems were recognized by area planners by the late 70's. Significant capital improvements have been and will continue to be a vital part of efforts to accommodate the growing demand for travel in eastern King County. Figure 1 illustrates the proposed Eastside Transportation Program, which if built, would cost over $1 billion, and would not be completed until well after 2000. A more immediate program that is currently underway involves numerous improvements directed specifically at Bellevue, consisting of extensive improvements to the downtown street network in the CBD, as well as the installation of HOV facilities on I-405, complete with special access ramps into the downtown. This near term program, which is illustrated in Figure 2, is projected to cost $188 million.

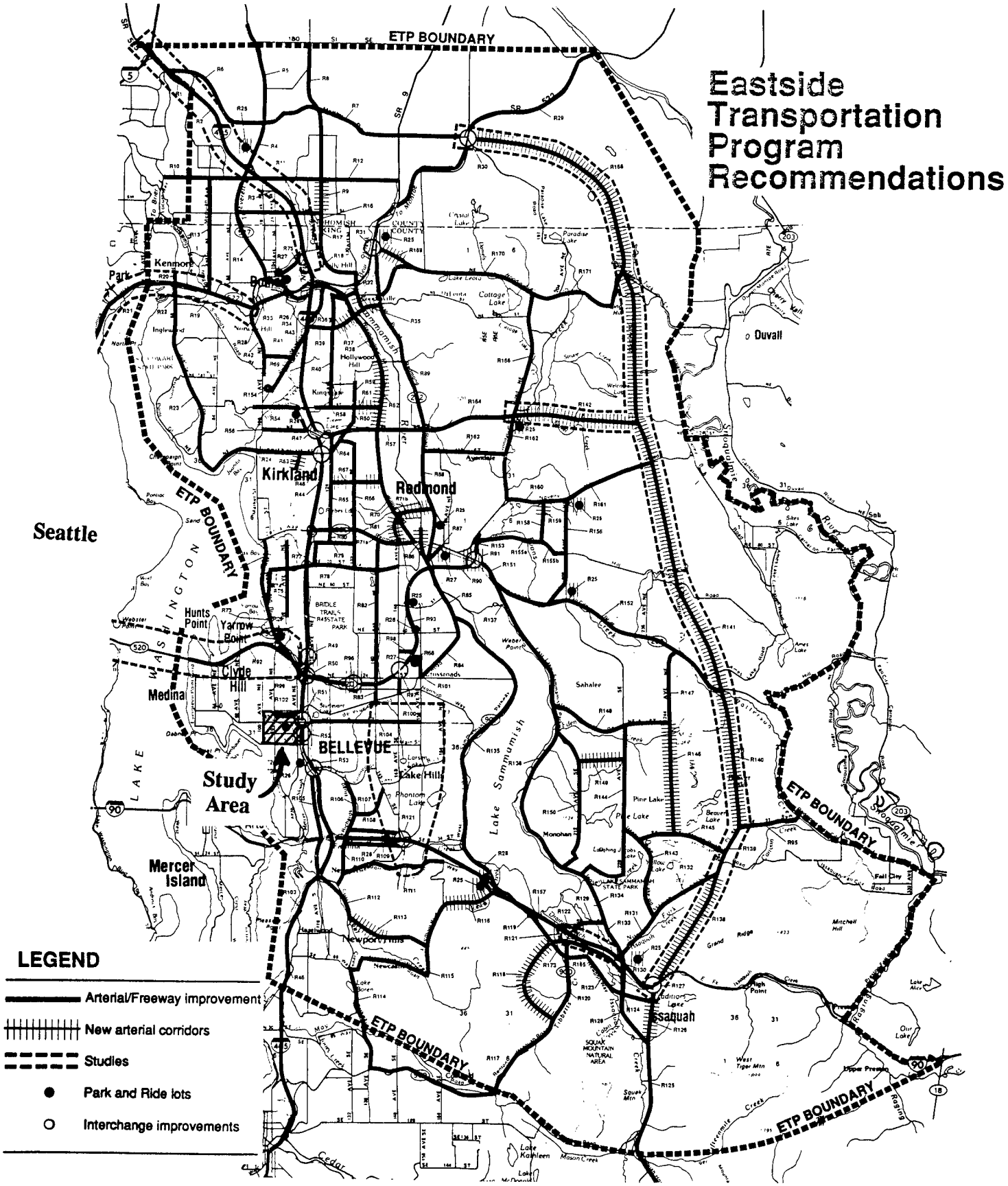


FIGURE 1

MAP OF GREATER BELLEVUE STUDY AREA

FIGURE 2

ONGOING ROAD IMPROVEMENT PROJECTS IN VICINITY OF DOWNTOWN BELLEVUE

Highlights of Non-CBD Improvements, Recommended Plan

DOWNTOWN STREETS

8 - Widen 108th, 110th and 112th Avenues;
9 - Provide NE 10th Street extensions to 106th on the west and to the I-405 interchange on the east;
10 - Operate NE 8th and 10th Streets as a one-way pair with high occupancy vehicle (HOV) lanes connecting to the HOV lanes on I-405;
15 - Complete missing portions of street grid;

OTHER ROADS

11 - Widen 112th Avenue from SE 8th Street to Main Street by providing a turn lane;
12 - Add a fifth lane to 116th Avenue NE from NE 12th Street to Northup;
13 - Widen Northup Way from three to five lanes between 116th Avenue NE and NE 24th Street;
14 - Widen 114th Avenue SE from SE 8th Street to Main Street;
19 - Widen Bellevue Way between I-90 ramp and SE 30th;

TRANSIT

16 - Build a new transit center on NE 6th Street between 112th Avenue and I-405 (contingent on upcoming Metro study) and build 1,300 parking spaces on the site;
17 - Provide access to transit center from I-405 southbound via a grade-separated ramp under NE 8th Street;
18 - Build a transit shuttle system (people mover) along NE 6th Street between the new transit center and Bellevue Way.

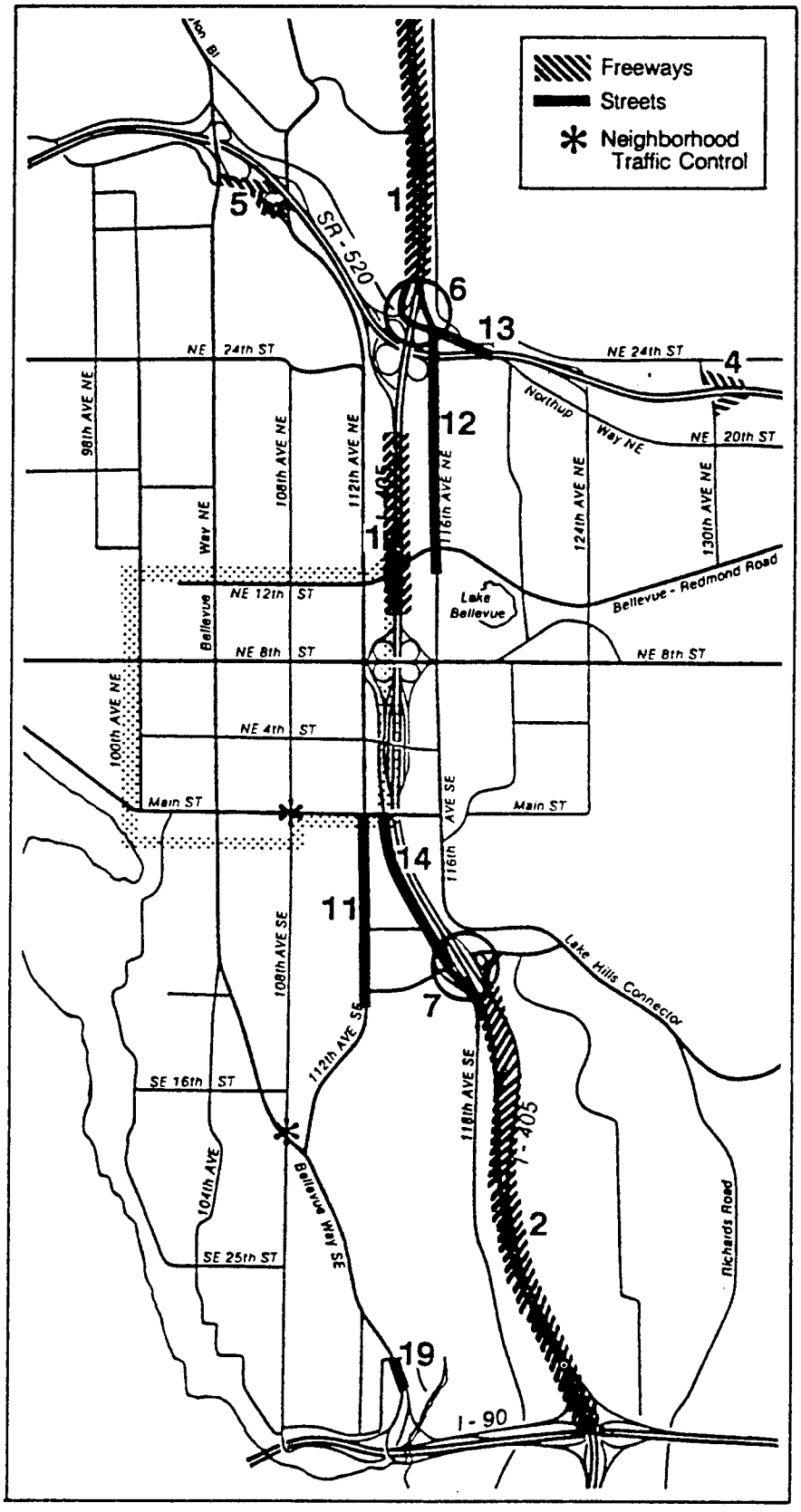


FIGURE 2 (CONTINUED)

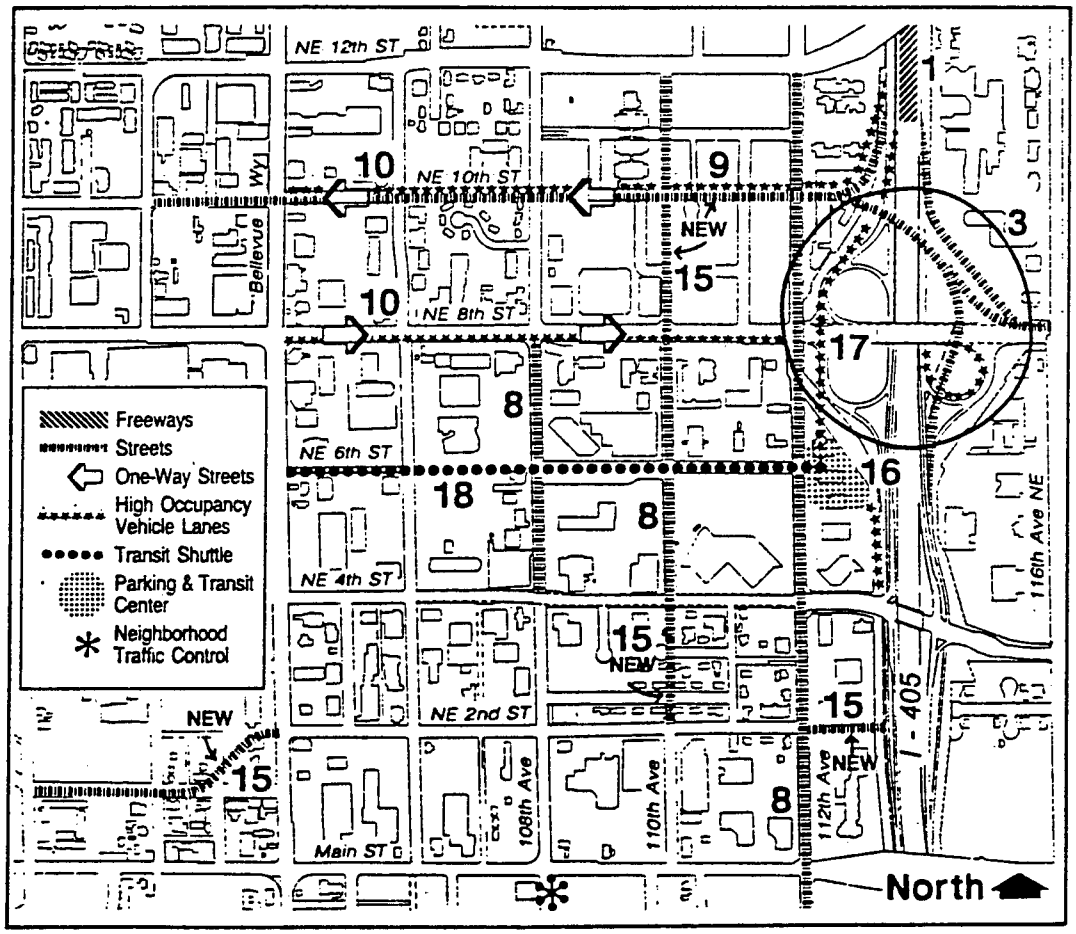
ONGOING ROAD IMPROVEMENT PROJECTS IN VICINITY OF DOWNTOWN BELLEVUE

Legend for Figures 13 and 14

FREEWAYS

1 - Widen I-405 between NE 8th Street and NE 70th Street;
2 - Widen I-405 between SE 8th Street and I-90;
3 - Modify the NE 8th Street/I-405 interchange, including a new westbound bridge over I-405 connecting NE 8th at 116th Avenue NE to NE 10th Street at 112th Avenue;
4 - New interchange on SR 520 at 130th Avenue NE (Part of Bel-Red/Overlake Transportation Plan);
5 - New eastbound on-ramp to SR 520 from Bellevue Way;
6 - New interchange on I-405 at 116th Avenue and Northup Way;
7 - Improved interchange on I-405 at SE 8th Street;

FIGURE 13
Highlights of CBD Improvements, Recommended Plan



Despite these significant capital projects, it has become clear to local officials that infrastructure enhancements alone will not satisfy the projected increase in traffic that will parallel the City's growth. Therefore, efforts have also been initiated to try to curb or manage the growing demand for travel, linked to an employment base that is expected to double by the year 2000.

The trends in development and traffic forced city officials to review and recommend drastic changes to the land use plans. In 1979, two important changes were introduced to project design rules in Downtown Bellevue: first, building setbacks were substantially reduced; second, reduced maximum ratios were placed on site parking. The intention of both measures was to increase the density of the downtown and make it more serviceable to transit. Maximum parking requirements for new buildings were reduced from 5 spaces per 1000 square feet to 2.7 per 1000 (actually 2.4 per 1000 square feet of net usable space); at the same time, the minimum was reduced to 2 per 1000 square feet. These changes helped bring about restrained parking conditions by the mid-1980's, and a basis for introducing viable alternatives to driving alone.

Designers of the parking reduction plan were concerned that, without efforts to provide alternatives for commuters, reduced parking facilities would simply result in spillover to streets and other facilities. To ensure the development and availability of effective alternatives, the city took three actions:

1. Beginning in 1983, the city has required the developers of all new buildings to develop and submit Transportation Demand Management (TDM) plans to indicate actions they would implement to provide alternative commute options. No formal ordinance was enacted to require these programs. Authority was given the city in its existing land use code, though no specific requirements are stated. The existing state Environmental Policy Act provided an important legal basis for requiring the actions. The early programs had minimal performance standards, but have since become more stringent. As a gauge on the effectiveness of the overall program, the city monitors evening peak period vehicle trips, which it regards as a mechanism to reevaluate program requirements. If the current program does not meet the desired trip reduction goals, the city could require imposition of additional actions to help achieve adequate performance.

2. In cooperation with Metro, the regional transit agency, a program of transit services has been evolving for downtown Bellevue. The existing program features a network of 15 bus routes, including regular, express, and park and ride services, that all converge at a Transit Center in downtown Bellevue (located on N.E. Sixth Street between 106th and 108th Avenues).

3. In 1986, the Bellevue Transportation Management Association (TMA) was formed to pool the resources of the City, Metro, and the Bellevue Downtown Association (BDA), which represents the private sector. Its purpose is to address parking and transportation access issues in the downtown. The TMA provides a broad package of transportation alternatives and related services for commuters on a contractual basis to the private sector. Functions performed services provided by the TMA include:

- Promotion of all HOV alternatives at worksites;
- A parking rental/management system for off-site rental spaces for employees;
- Development of pedestrian facilities and amenities in the downtown;
- Personalized transportation assistance (carpool, vanpool and bus information) for employees/employers;
- Carpool certification programs for high-rise buildings;
- Implementation of transportation management programs for developers and employers;
- Promotion of flexible working hour programs;
- A Guaranteed Ride Home Program for HOV users which provides subsidized taxi rides for emergencies and changes in work schedules;
- A park and shuttle service for downtown employees, scheduled for September 1989;
- A downtown circulator to operate during lunch hours, also scheduled to begin in September 1989;

3. OVERALL EFFECTS OF PROGRAM

Assessment of the effectiveness of the TDM program efforts in the Bellevue CBD has been greatly facilitated by data compiled by Seattle Metro under its ongoing HOV/TSM Evaluation Study. This study has been tracking formal TDM program efforts in place in four locations in King County. These locations include downtown Bellevue and three adjacent suburban areas of lower density. The primary mechanism for gauging program impacts has been an annual employee survey, which samples a wide variety of employment sites within the individual areas. The surveys, which obtain data on modal choice and awareness of program features, have been coupled with physical vehicle occupancy counts at each site.

What makes the Metro study data so valuable is that the universe of sites where travel monitoring is being done includes a number of statistical control sites. These are employment locations scattered throughout King County that are similar in most every respect to the TDM project sites, except they feature no ongoing TDM program efforts. They are otherwise identical in terms of type of employment, size of employer, density and other characteristics of the surrounding area, and availability of transportation options.

The baseline surveys for the Metro evaluation study were conducted in 1987. A number of TDM program elements were then implemented and the same organizations resurveyed in 1988. A third survey was scheduled for the summer of 1989, but the data were not available at the time of writing of this report.

The TDM program elements implemented between 1987 and 1988 at all four project sites included assignment of employee transportation coordinators, offering of a vanpool fare subsidy, and a guaranteed ride home program. While these elements were implemented in downtown Bellevue at the same time, they were to follow the significant list of other measures described earlier, which the city began to implement in 1983.

Modal usage rates compiled through the 1988 employee surveys are summarized in Table 1 for downtown Bellevue vs. the regional control sites. The percentage of commuters driving alone to the Bellevue CBD was only 63.2% in 1988, while the comparable rate at the control sites was 81.8% Bellevue makes up for its difference with both higher rates of transit use (10.9% vs. 3.3%) and carpooling (18.5% vs. 11.0%).

To estimate the effectiveness of downtown Bellevue's TDM program in reducing vehicle travel, its travel mode split is converted to a vehicle trip production rate, which is then compared with the regional control sites. The vehicle trip production rate is estimated by assuming that each drive alone commuter generates 1 vehicle trip, carpoolers 1 vehicle trip for every 2.5 riders, vanpoolers generate 1 vehicle trip for every 12 riders, and bus riders travel at the rate of 30 persons per vehicle trip. From this formula, it is estimated that Bellevue CBD commuters are generating 71.0 vehicle trips per 100 employees, compared to 86.4 trips per 100 at the regional control sites, or 15.4 vehicle trips less per 100 employees.

How significant is this trip reduction? If Bellevue's 24,000 employees traveled to work at vehicle trip rates equivalent to the regional control sites, they would generate an additional 24,000 x 15.4/100 = 3696 daily one-way vehicle trips. Thus, Bellevue's TDM program may be credited with a trip reduction of:

$$[(24{,}000 \times .864) - (24{,}000 \times .71)] / (24{,}000 \times .864) = 17.8\%$$

over ambient conditions.

The average vehicle occupancy of these travelers is calculated assuming the same number of persons per vehicle as above, and not including the "other" category in the total. Using this formula, a vehicle occupancy of 1.32 persons per vehicle is estimated for downtown Bellevue, which compares to 1.12 at the control sites.

It is reemphasized in summary that the difference of 15.4 vehicle trips per 100 employees between downtown Bellevue and the regional control sites is due both to the described "TDM program" as well as conditions that existed at the site before the program, such as development controls, restricted parking and focused transit service. The incremental effect of the 1987/88 program features may be inferred from the comparison of 1987 and 1988 conditions in Bellevue shown in Table 1. Following the addition of the transportation coordinator, the vanpool subsidy and the guaranteed ride home program, vehicle trip production dropped from 72.4 to 71.0 per 100 in Bellevue, while it actually increased at the regional control sites during the same period. These additional TDM elements therefore may be credited with at least a 1.9% reduction when first measured in 1988; the 1989 survey may show further reductions as the program becomes better known.

TABLE 1

COMPARATIVE MODAL SPLIT
BELLEVUE CBD vs. REGIONAL CONTROL SITES

	Bellevue CBD		Control Sites	
	1987	**1988**	**1987**	**1988**
Travel Mode				
Drive Alone	64.2%	63.2%	78.8%	81.8%
Bus	7.9	10.9	4.8	3.3
Carpool	19.5	18.5	12.8	11.0
Vanpool	1.2	0.7	0.6	0.8
Other	7.1	6.4	3.0	3.1
Vehicle Trips per 100 Employees*	72.4	71.0	84.1	86.4
Average Vehicle Occupancy	1.28	1.32	1.15	1.12

* assumes 2.5 persons per carpool and 30 persons per transit trip

4. INDIVIDUAL PROGRAM EFFORTS

A closer examination of the composition of the above-average rates of HOV use in Bellevue shows a number of equally above-average individual efforts. In the section below, we detail the efforts of three individual programs:

- o US WEST Communications, located in Bell Terrace
- o Puget Power, located in One Bellevue Center
- o CH_2M Hill, located in Security Pacific Plaza

Below are brief profiles of the history, components and impacts of these programs.

US WEST Communications

US WEST, formerly Pacific Northwest Bell, has the most impressive program in the group. It has achieved a 26% drive alone rate among its employees, which has been attained largely through parking management techniques. This level of trip reduction is unmatched in the Bellevue area. US WEST's rate of high occupancy vehicle use is 30% higher than the second ranking program in the Bellevue CBD, and 40% higher than an average of downtown businesses.

In 1981, developers of the company's new Bellevue office opted for the minimum parking capacity for employee parking. Their primary concern in the action was minimizing their costs, but they also took initiative to ensure that complementary actions were developed, in terms of options and incentives, to ensure that the parking would be adequate.

Only 408 parking spaces are provided at the company's downtown Bellevue site for its 1,150 employees. With the advice of a transportation consultant, the company established a pricing schedule for parking with inverted rates: single-occupant vehicles (SOV's) are charged $60/month for parking, 2-person carpools are charged $45/month, and parking for vehicles with 3 or more occupants is free. Beyond the pricing factor, further restrictions apply to use of the parking. The parking facility is a 4-story garage, with two floors providing reserved spaces for HOVs. A third floor provides spaces for vendors, fleet operators, and short-term occasional users, and only one floor is available for SOV parking. This means that SOV spaces are on a first-come/first-served basis, so that availability of the space, even at a $60/month rate (paid daily) is not reliable. Space is available at other off-site locations at market rates.

The company took an aggressive stance in selling its limited parking program to the city and its employees. The city, which advocates reduced parking with its TDM policy, was nevertheless concerned that the limited capacity proposed by US WEST would produce spillover problems unless adequate efforts were made to provide alternatives. The company took the lead in selling the program, promising carpool incentives, flexible work hours programs, and a full-time transportation coordinator, so the city eventually agreed to the limited parking proposal.

Many employees were initially somewhat bitter about the need to find alternative commuting arrangements at the new location, but soon adapted to the new environment. The situation was helped by the fact that many of the employees, having been transferred in a consolidation from Seattle, were already conditioned to using carpools and transit to get to work.

Most employees rideshare as their alternative to cope with the limited parking situation. As illustrated in Table 2, survey data for June 1988 indicate that only 25.7% of US WEST's employees drive alone, 12.8% ride transit, 44.7% ride in carpools, 1.8% in vanpools, 2.0% other, and 13.0% in multi-modal arrangements typically driving to access some HOV mode. It should be noted that many employees who carpool with co-workers drive to meet their carpools at a park and ride lot within a short distance of downtown (1 mile or so), and then form carpools to reach work.

If US WEST employees are loaded into vehicles at the occupancy rates used for the downtown Bellevue analysis, it is estimated that they are generating 45.2 vehicle trips per 100 employees (this calculation assumes that "Multi-Mode" trips occur at an average occupancy of 12 persons per vehicle). Thus, 1150 employees generate only 520 vehicle trips. Comparing this to the regional control sites, US WEST's employees generate 86.4 - 45.2 = 41.2 vehicle trips per 100 less than conceivably would be made at typical regional rates in the absence of a TDM program. Stated another way, if US WEST's employees travel at regional rates, they would generate 1150 x 41.2/100 = 47 additional daily one-way vehicle trips; this difference credits US WEST with a trip restriction rate of [(1150 x .864) - (1150 x .452)]/(1150 x .864) = 47.6% over and above ambient conditions.

Another impressive comparison is to relate US WEST to the rest of downtown Bellevue without US WEST. This analysis has also been performed in Table 2. Downtown Bellevue without US WEST is estimated to have a trip production rate of 83.1 vehicle trips per 100 employees. The effectiveness of US WEST's program is so great that, without it's inclusion, downtown Bellevue is only 86.4 - 83.1 = 3.3 vehicle trips/100 better than the rest of the region.

PUGET POWER

Puget Power is an example of a large employer with modest initial TDM efforts that is now having to respond to changing conditions with a more aggressive program. In the summer of 1983, Puget Power consolidated its Bellevue-based employment force from six locations into three buildings in downtown Bellevue. The company knew from the start that the City's restrictions on parking would affect their parking capacity, and took steps to make the situation work for employees.

Puget had available roughly 650 spaces for its 830 employees at the time of consolidation, located in several structures and surface lots adjacent to the building sites at One Bellevue Center. To make maximum efficient use of the limited capacity, the company developed a program with the following components:

TABLE 2

COMPARATIVE MODAL SPLIT RATES AND TRIP REDUCTIONS FOR INDIVIDUAL BELLEVUE CBD PROGRAMS

	US WEST	Puget Power	CH2M Hill	Regional Control Sites	Bellevue Without US WEST
Employment	1150	830	400		
CBD Travel Mode					
Drive Alone	25.7%	76.6%	54%	81.8%	79.6%
Bus	12.8	8.4	17	3.3	9.1
Carpool	44.7	12.1	12	11.0	7.7
Vanpool	1.8	2.9	-	0.8	0.3
Other	2.0	NA*	17	3.1	1.0
Multi-Mode	13.0	NA	-	NA	2.3
Vehicle Trips per 100 Employees*	45.2	75.6	59.4	86.4	83.1
Average Vehicle Occupancy	2.17	1.24	1.40	1.12	1.19

* assumes 2.5 persons per carpool and 30 persons per transit trip. Calculation of vehicle trips per 100 employees assumes 6.4% of Drive Alone is "Other", since not broken out.

- Parking was allocated to employees using a lottery system. After reserving a set number of spaces for visitors, handicapped persons, fleet vehicles and executives, the remaining spaces were distributed to employees based on low number drawn in a one-time lottery.

- Persons wishing to carpool or use vanpools were guaranteed a space, albeit not a reserved space.

- A $21 monthly charge was imposed for all employee parking.

- Persons wishing to use transit were offered a $12 monthly discount against a transit pass.

- A transportation coordinator was made available to assist employees in forming commuting alternatives.

With this program, Puget was able to place 5.2% of its employees in carpools, 1.4% in vanpools, and 8.4% in transit, with the remaining 85% primarily driving alone. Using the standard occupancy rates from above, this suggests that Puget was generating about 87.5 vehicle trips per 100 employees, which actually is above both the rate for downtown Bellevue, 70 per 100, and even the control sites, at 86.4 per 100.

As of March 1989, however, Puget learned that in May it would lose one of its surface parking lots to another tenant with lease rights. This means that the company lost 110 spaces, reducing its capacity from 650 to about 540. To cope with the sudden change, the company implemented the following additional measures:

- Carpoolers and vanpoolers are now allowed to park free, and are offered reserved, preferential spaces.

- The number of "free parking days" allowed carpoolers and transit users was doubled from 2 days to 4 days, to take into consideration the occasional need of a car for personal reasons.

- The transit subsidy was raised from $12 to $15 per month.

Concurrent with these new program features, Puget also contracted with the Bellevue TMA for transportation coordination with its employees. As part of the service contract, the TMA worked with Puget to encourage formation of HOV arrangements. Special kick-off promotional incentives of $35 gift certificates were offered to new HOV users who agreed to participate for 3 months, and also $15 certificates were awarded to existing HOV users. Within a month of the presentation of this new program, the number of carpoolers at Puget increased from 43 to 100 and a second 12-passenger vanpool was formed. No additional transit usage occurred, although 7 new persons began using transit and 7 existing riders switched to other modes. As illustrated in Table 2, these additions have changed the mode split to roughly 12.1% carpool, 2.9% vanpool, 8.4% transit (stayed the same), and 76.6% drive alone/other. This new mode split implies that the Puget employees are

currently generating about 82 vehicle trips per 100 employees, down from the 87.5 previously; so the new program has reduced (87.5 - 82) = 5.2 additional vehicle trips per employee, or 43 trips from 830 employees. If it is assumed that 6.4% of employees are found in the "other" category, equivalent to the population norm for the CBD as presented in Table 1, and this is subtracted from the drive alone share, then Puget may be credited with a trip rate of 75.6. Even this optimistic rate is above the average of 7 per 100 for downtown Bellevue, but below the average of 86.4 for the control sites. Applied to the employee population of 830, the reduction rate of the Puget TDM program reduces (86.4 - 75.6)/100 x 830 = 90 more vehicles than would be reduced by the normal forces inherent at the control sites. This corresponds to a [(830 x .864) - (830 x .756)]/(830 x .864) = 12.6% reduction over ambient conditions.

CH2M HILL

CH2M Hill is an architectural/engineering firm of approximately 400 employees that has used a "transportation allowance" program in conjunction with restricted on-site parking to accomplish an exemplary level of trip reduction.

When contemplating its relocation to its new building at Security Pacific Plaza in downtown Bellevue in 1987, the company realized that it was going to experience a limitation in parking capacity. Lease provisions allotted 325 spaces for staff for the first three years, and then a reduced number for subsequent years -- only 210 spaces in years 4 through 8, and then only 195 spaces in years 9 and 10. While it appeared that parking would be adequate for the first two years, the company's growth plans plus the declining allotment meant that they would soon see a parking problem. So it decided to implement a TDM program concurrent with the move to begin to condition employees to the need to seek alternatives to driving to work.

The program centers around a "transportation allowance." Each employee was given a monthly compensation increase of $40 per month beginning with the move to cover the cost of parking at the new site. In actuality, the parking charge at the new site to CH2M Hill was less than $40 per month, but it was decided to charge $40, and commit the overpayment to a parking fund. This fund was then used to finance direct subsidy payments to carpool and transit users. Transit users are provided with a $15 monthly pass discount, and carpoolers are given a free parking space. Additionally, both qualify for the $40 transportation allowance.

The combination of the restricted parking, the transportation allowance, and the HOV subsidies has had an important impact on mode choice. Listed below is the company's modal split before and after the move:

Travel Mode	Before (Dec. 86)	After (Jan. 88)
Drive Alone	89%	54%
Carpool	9%	12%
Bus	1%	17%
Walk/Other	1%	17%

This program has reduced CH2M Hill's vehicle trip generation rate from 92.6 per 100 at the previous location to 59.4 at the new location, which is a vehicle trip reduction of (92.6 - 59.4) = 33.2 vehicle trips per 100 employees, or 133 over the base of 400 employees. This corresponds to a reduction of 370 - 238/370 = 35.7% reduction. If CH2M Hill is compared to the regional control sites, their program reduces 86.4 - 59.4 = 27 vehicle trips per 100 more than would occur in the ambient conditions, or approximately 31.2% less.

7. CASE STUDY: BISHOP RANCH

CONTRA COSTA COUNTY, CALIFORNIA

1. SITE DESCRIPTION

Location and Character of Site

Bishop Ranch is a large suburban office park in Contra Costa County, California. As Figure 1 illustrates, it is located in the northeastern fringe of the San Francisco metropolitan area, adjacent to the town of San Ramon, approximately 35 miles from downtown San Francisco. Opened in 1981, the 585-acre business community currently includes about 5 million square feet of office space, accommodating 12,000 employees. When completed in 1995, the park will include 8 million square feet of office, hotel, shopping and recreational facilities, while providing employment for 25,000 employees.

The area was largely undeveloped before the park was sited in the early 1980's. While there has been complementary residential growth near the business park and the town of San Ramon as Bishop Ranch has grown, land use in this area is still at a very low density.

Employment in the Bishop Ranch business park was approximately 12,500 in 1987, and is projected to reach 25,000 at buildout in 1995. It is primarily a professional, white-collar employment center. The 1987 employment composition was approximately 38% Professional / Technical, 29% Executive / Managerial, 28% Clerical / Administrative, 2% Sales, and 4% Other. The major tenants of the Park are Pacific Bell with 6,900 employees in one location, and Chevron with 2350 employees in a single campus location, Chevron Park, plus others scattered throughout the complex. The remainder of the park consists of small to moderate size employers in multi-tenant buildings or complexes. Figure 2 illustrates the layout of the park and the location of major tenants.

Transportation Facilities

The principal transportation facilities serving the park are highways, chiefly Interstates 680 and 580. I-680 is a six-lane facility, with access ramps at two locations. The location of the park relative to these facilities is illustrated in Figure 1. For persons traveling outward from the San Francisco area, the nearest stations on the BART system are located at Walnut Creek and LaFayette, approximately 11 miles north of Bishop Ranch. Shuttle bus service operates between the stations and the park.

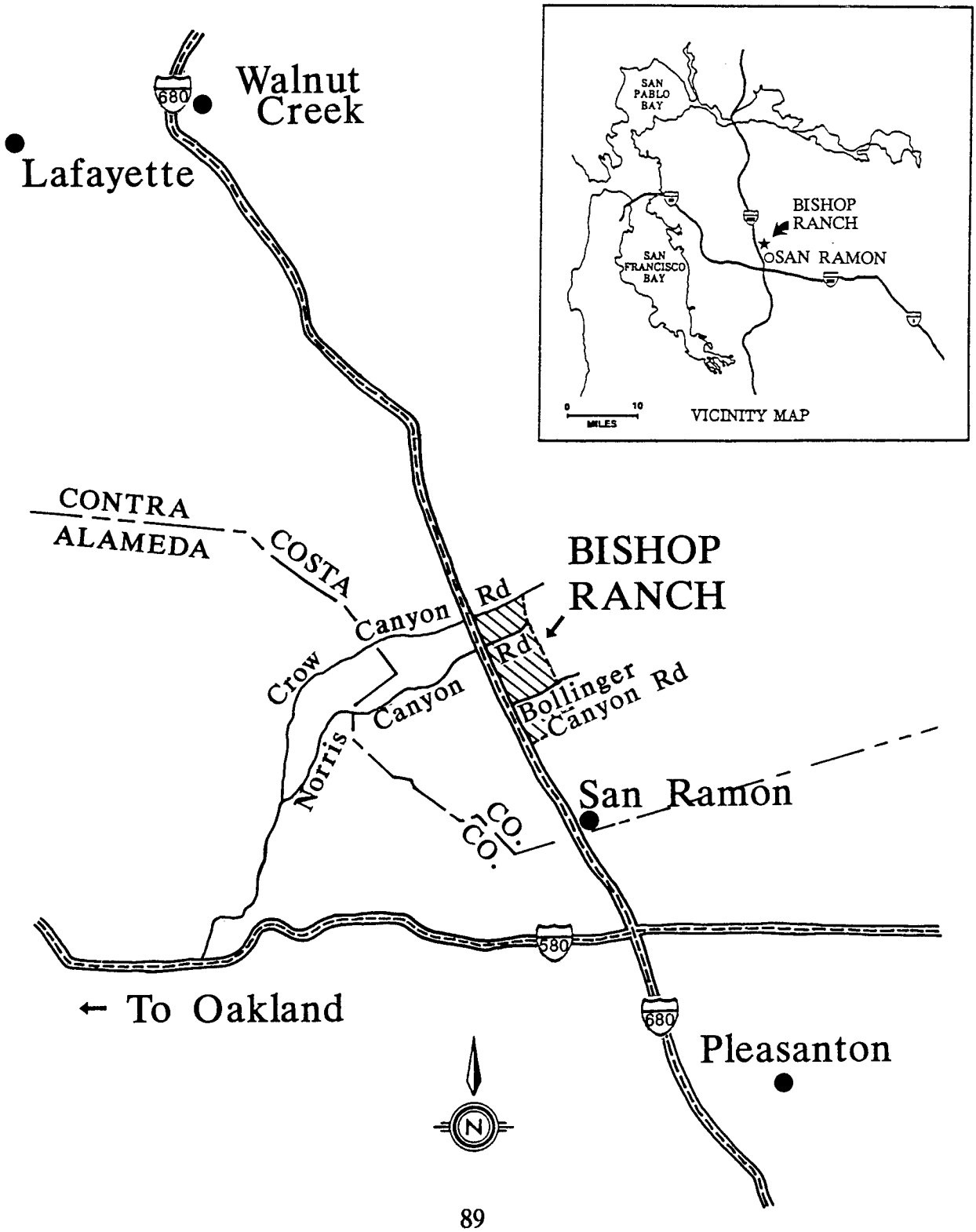
2. BACKGROUND AND MOTIVATION FOR TDM PROGRAM

Two forces combined to foster development of a comprehensive transportation management program at Bishop Ranch. First, as a condition of building permit approval, the two major landowners at the site, Sunset Development and Pacific Bell, were required to find a way to reduce their respective peak hour vehicle trip generation by 40%.

FIGURE 1

LOCATION OF BISHOP RANCH

AND MAJOR TRANSPORTATION FACILITIES



Bishop Ranch 2
2678 Bishop Drive
2680 Bishop Drive
2682 Bishop Drive
2694 Bishop Drive
Lox, Stock & Bagel Deli,
2682 Bishop Drive
Wells Fargo Express Stop,
2694 Bishop Drive

Bishop Ranch 6
2400 Camino Ramon
2410 Camino Ramon
2420 Camino Ramon
2430 Camino Ramon
2440 Camino Ramon
Child Care Assistance Office,
2420 Camino Ramon
Pot Belly Deli,
2420 Camino Ramon
Transportation Centre,
2420 Camino Ramon
Wells Fargo Express Stop,
2420 Camino Ramon

Bishop Ranch 8
3000 Executive Parkway
4000 Executive Parkway
5000 Executive Parkway

Bishop Ranch 11
2301 Camino Ramon
2303 Camino Ramon
2305 Camino Ramon

Bishop Ranch 12
One Annabel Lane
Two Annabel Lane
Center For Higher Education,
One Annabel Lane

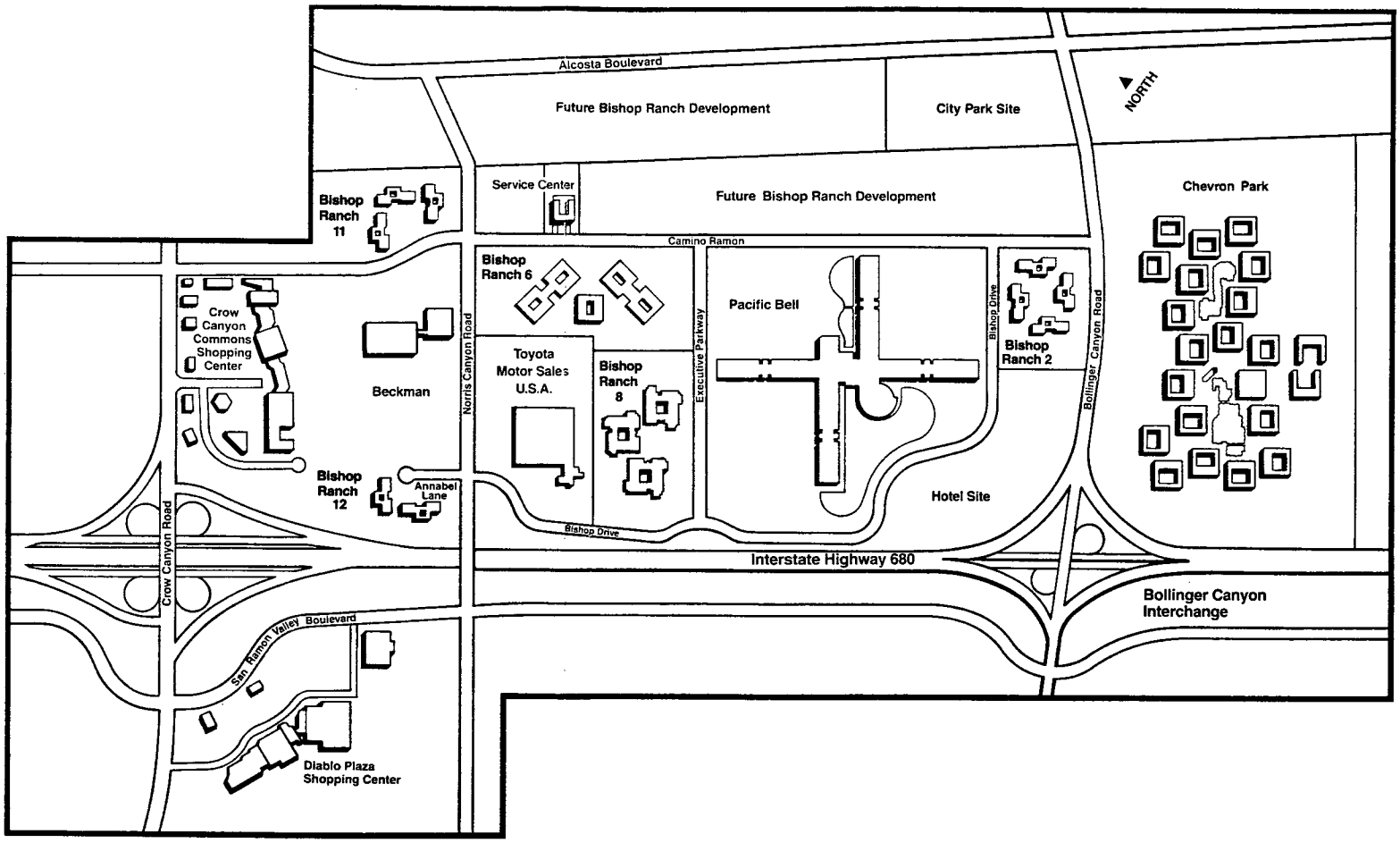


FIGURE 2

MAP OF BISHOP RANCH BUSINESS PARK

Independent of this formal requirement, however, the two organizations had internal motives for wanting to manage the park's potential transportation problems: to keep traffic congestion from diminishing access to the park, and to help employees cope with the relocation of their workplace to Bishop Ranch.

To better understand its management options for the park, Sunset Development, the Park's major developer, contracted with a transportation consultant in early 1983 to review the situation and offer recommendations. The central element of the consultant's plan was to form a transportation management association among the park's members for the purpose of coordinating the proposed ridesharing and parking management programs. In 1984, the Bishop Ranch Transportation Association (BRTA) was formed to implement the proposed program. The by-laws for the BRTA limit voting membership to property owners in the park, which included at the time of formation:

- Sunset Development, which owns five of the major multi-tenant complexes in the park, currently housing about 3500 employees;
- Pacific Bell, which owns a 1.7 million sq.ft. building in the park that houses about 7000 employees;
- Chevron, which owns a 143-acre campus style development in the park that houses about 3500 people;
- Toyota, owner of 30 acres at the site, supporting a warehouse with about 100 employees; and
- Pacific Telesis, whose real estate division had purchased property from one of the parks major tenants and leases it back to them and several other companies engaged in light manufacturing.

Of these, only the first three are participating as voting members of the Association. Costs for the program are negotiated among the three, with some costs wholly paid by one or the other.

The BRTA felt that the essential element to its transportation program was the establishment of an on-site transportation center, which could offer personalized assistance to employees in selecting their best commute and encourage them to use alternatives to driving alone. The Association contracted with RIDES for Bay Area Commuters, the regional ridesharing organization, to provide a full time manager for the Transportation Centre. Services provided by the Centre include:

- Computerized ridematching using the RIDES system;
- Sale of discounted transit tickets and transit scheduling information;
- Special assistance for companies relocating to Bishop Ranch; and
- Vanpool formation assistance and referrals to existing vans.

While the consultant study recommended ridesharing as the principal short to medium-term alternative for commuters to the site, efforts were also directed toward cultivation of several transit services. The two major landowners both provide transit shuttle service connecting the park with the regional BART system. Sunset provides a free luxury bus on a 20-minute headway for its tenants, which operates during commute hours between the park and the Walnut Creek BART station. Pacific Bell contracts with a local transit agency, County Connection, to provide express bus service at a cost to users of $1 each way between the Lafayette BART station and the Pacific Bell building during commute hours. In addition to these services, a BART Express bus now operates through the park all day on 35-minute headways, providing emergency midday transportation back to BART. Also, both Sunset and Pacific Bell shuttles offer a noon shopper shuttle to the nearest shopping/restaurant areas to reduce the perceived need for a car during the day.

Flexible work hours were recommended by the consultant study, and the policy is promoted in the park. However, it is a program prerogative exercised by the individual employer, with no one charged with the responsibility of synchronizing time shifts among the various firms.

Marketing and outreach activities are, of course, important elements of the transportation program. Supplementing these elements are supportive programs in employee relocation assistance and child care. The relocation assistance (in addition to identifying commuting alternatives) is an effort by some employers to help employees in hardship cases who wish to change their residence location to lessen their new commute burden, but realize difficulties in the transfer. In various instances the employers have assisted with the transactional costs in helping the employee move to a closer location. In terms of day care, Bishop Ranch does not maintain a day care center on site, but supports an active care referral service to help workers find the best opportunities in their respective communities.

Within the past year, the Bishop Ranch business park was annexed into the City of San Ramon, and as a result, now is formally subject to the requirements of a TSM ordinance, similar to the relationship between Hacienda Business Park and the city of Pleasanton, just to the south. Under the new conditions, the responsibility for transportation management and trip reduction has been shifted to employers. This has caused a much more proactive effort from some of the park's major employers. As yet, the city has not indicated what if any penalties might be imposed for non-compliance with its ordinance; at the present time the only requirement is a report from each employer by June 1990 on current commute patterns by employees and a management plan for meeting the trip reduction goals.

3. OVERALL EFFECTIVENESS OF PROGRAM

Evaluating the effectiveness of the TDM program at Bishop Ranch has been facilitated by the monitoring activities and data base compiled by Bay Area RIDES. RIDES conducts an annual employee survey in the park that achieves about a 35% response rate. Surveys have been conducted in June 1986, October 1987 and December 1988.

Data complied by the RIDES staff strongly suggests that the combination of elements in the Bishop Ranch TDM program has had a significant impact in reducing employee vehicle travel, and in particular, peak-hour vehicle travel. In 1988, an estimated 70.2% of all Bishop Ranch employees drove alone to work; 16.3% commuted in carpools, 8.7% in vanpools, 3.2% in one of several transit modes, and the remaining 1.7% reached the park by other means. Assuming that each carpool carried 2.5 travelers, each vanpool 12 travelers, and each transit vehicle 30 travelers, it is estimated that Bishop Ranch employees generate 77.6 daily one-way vehicle trips per 100 employees. Stated another way, this corresponds to an average vehicle occupancy rate of 1.27 persons per private vehicle trip.

What this means is that the population of 14,000 employees produces about 10,864 daily vehicle trips. Only 6244 of these vehicle trips are estimated to occur in the AM peak hour, defined as 7:30 to 8:30 AM. Therefore, with the combination of shifting to higher occupancy travel modes and traveling outside the peak hour, the Bishop Ranch program has been credited with a (14,000 - 6244) / 14,000 = 55.4% reduction in peak hour vehicle trips over the situation where every employee would drive alone in the peak hour. Based on the County's 40% peak hour vehicle trip reduction requirement, the park has easily met the primary trip reduction goals.

Of course, even without a formal TDM program, it would be expected that a percentage of employees would find a method of travel to work other than driving alone. It is the difference between this "background" rate of vehicle trip generation and that realized under the formal program which is the net effectiveness attributed to the TDM program. To help identify a basis for comparison, Bay Area RIDES was consulted to furnish an estimate of modal split rates for work travel to suburban locations like Bishop Ranch where no TDM programs were underway. Two locations were identified with similar characteristics to Bishop Ranch, but without TDM. They are Walnut Creek, in Contra Costa County, and Santa Rosa, in Sonoma County. The first is a rapidly commercializing area located near a suburban BART station, while the second is a town developing as a new high growth center north of San Francisco, with no major transit service. The following table lists the comparative travel characteristics at the various sites:

	Bishop Ranch	Walnut Creek	Santa Rosa
Travel Mode			
Drive Alone	70.2%	89.9%	91.3%
Carpool	16.3	6.9	4.7
Vanpool	8.7	0.5	0.1
Transit	3.2	2.6	1.4
Other	1.7	0.1	2.5
Vehicle Trips per 100 Employees*	77.6	92.8	93.2
Average Vehicle Occupancy	1.27	1.08	1.05

* assumes 2.5 persons per carpool and 30 persons per transit trip

If these two other suburban locations can be used as reference points for commuting behavior in the absence of TDM measures, then the program at Bishop Ranch may have reduced the following number of vehicle trips from the roadways:

Vehicle Trip rate, Bishop Ranch = 77.6 per 100

Vehicle Trip rate, control sites = 93 per 100 (average, both control sites)

Rate Difference: 93 - 77.6 = 15.4 per 100

Total Reduction: 14,000 x 15.4/100 = 2156 vehicle trips.

Percent Reduction: 2156/(14,000 x .93) = 16.6%

Unfortunately, it is not possible to estimate the net impact of the TDM program in reducing peak hour vehicle trips, since comparable data are not available regarding the time of day distribution of work trip arrivals elsewhere in the county, or the distribution at the park before the practice was begun.

Tracing the combined effect of program actions that induce changes in modal choice as well as time of day can be quite complicated. Added to this are shifts in residence location, which have an impact on travel patterns and choices. However, thanks to the extensive

data of RIDES, it is possible to trace trends in some of these important factors over a three year time period, offering some important insight into the following issues:

- What is the ability of the TDM program to maintain its effectiveness over time?
- Does flextime contribute to a better trip reduction rate than would occur without flextime? Stated another way, does offering employees flexibility in their arrival/departure times encourage or discourage use of high-occupancy vehicle modes?
- Does relocation of employee residence aid or detract from trip reduction goals?

These are all important research questions that can be broached to varying degrees with the Bishop Ranch survey data.

The first issue probed is the stability of the TDM program over time. Shown below are modal split rates for travel to the park for the three years that data have been obtained:

Travel Mode	**1986**	**1987**	**1988**
Drive Alone	55.1%	67.7%	70.2%
Carpool	26.6	18.5	16.3
Vanpool	7.7	8.3	8.7
Transit	9.0	4.1	3.2
Other	1.3	1.4	1.7

These data show that, despite a respectable usage rate of high occupancy vehicles at the present time, the rate of use has been gradually decreasing over time. Carpool usage has fallen more than 10 percentage points since 1986, and transit usage has fallen almost 6 percentage points. Usage of vanpools has increased slightly, by about 1 percent, but most of the change in travel over the three year period has been a significant increase in the drive alone rate, which has increased by about 15%.

The decline in HOV usage was greatest between 1986 and 1987, and seems to have slowed somewhat over the last year. But the question remains: Why has this decline occurred? Because of the particular survey questions asked, the RIDES data do not permit a true causal analysis of these trends. However, by looking at some parallel trends, it is possible to suggest some contributing factors to the decline.

The data in the following table confirm that, indeed, employees at Bishop Ranch are adjusting their work hours to travel outside the peak hour.

Bishop Ranch
Percent of Employee Arrivals

Morning Arrival Time	1986	1987	1988
Before 6:30	4.1%	2.7%	3.1%
6:30 to 7:00	9.3	5.2	5.3
7:00 to 7:30	31.0	21.6	22.8
7:30 to 8:00	28.9	30.6	29.4
8:00 to 8:30	20.3	27.7	27.4
8:30 to 9:00	5.2	11.2	10.6
After 9:00	1.2	1.0	1.4

What these figures indicate is that the flextime policies as currently operative, have (1) pushed the peak later into the day, and (2) have "flattened" the peak so that the second highest hour is now a higher fraction of the peak than before. In 1986, 44.4% of all workers arrived before the designated 7:30 to 8:30 peak hour, 49.2% during and 6.4% after. In 1987, the distribution had shifted such that only 29.9% traveled before the peak, 53.3% during the peak, and 12.2% after. In 1988, the trend continued, with only 31.2% traveling before the peak, 56.8% during the peak, and 12.0% after. So in effect, travel during the peak hour was actually increased over the measured three year period, with a slight downturn in 1988, but in general there has been a movement toward later arrivals. These same trends are seen in the departure times, which have not been shown here. The second highest hour as a percentage of the peak has also increased during this period. In 1986 the second highest hour had 55% as many trips as the peak; in 1897, the ratio increased to 56.3%, and by 1988 it had reached 58.8%.

These data encourage several conclusions. First, given a choice, these travelers would prefer to travel later in the day, and not both earlier and later, which would provide greater relief to the peaking problem. Interestingly, the tendency at most other sites where flextime has been implemented has been toward earlier arrivals. Second, it does not appear that the flexible hours policies are coordinated among the park's employers, so schedules are not synchronized. Failing such synchronization, the peak hour has actually increased under flextime over 1986 levels, and the second highest hour has grown steadily higher. There has not been any transfer, on a percentage basis, outside the peak 2 hours.

The second issue pursued concerning flextime is whether allowing flexibility in employee work hours aids or detracts from use of alternate modes. Drawing upon the only two years for which data are available, 1987 and 1988, listed below are rates of single occupant vehicle (SOV) use by time period. The data illustrate a strong correlation between travel outside the peak hour and increased rate of use of SOVs.

Percentage of Travelers in Time Period who Drive Alone

Morning Arrival Time	1987	1988
Before 6:30	81.3%	89.3%
6:30 to 7:00	73.2	69.3
7:00 to 7:30	58.3	57.4
7:30 to 8:00	63.0	65.6
8:00 to 8:30	73.5	77.8
8:30 to 9:00	82.3	82.9
After 9:00	92.9	87.0

What these data show is that employees who travel before 7:00 and after 8:00 AM are significantly more likely to drive alone than those arriving during that hour. This suggests than most employees who choose to travel outside the peak do not take advantage of that flexibility to facilitate ridesharing or transit scheduling, but see it as a more relaxed environment in which to drive alone. As the data in the previous table documented a shifting of the employee population toward arrival times of after 8:00, the observation is made that rates of driving alone are highest during these times. In 1986, 26.7% of all employees arrived after 8:00; by 1987 this fraction had reached 39.9%, and remained roughly at that level in 1988, or 39.4%. Using the 1988 data, it is estimated that employees traveling during the 7:00 to 8:00 period generate 70.8 vehicle trips per 100 employees, while those traveling after 8:00 generate 84.9 trips per 100 employees. The impact of the observed shift in time period on the number of vehicle trips that may have been generated can be estimated as follows:

Number 1988 employees = 14,000

Additional percentage traveling after 8:00 AM,
1988 vs 1986 = 39.4 - 26.7 = 12.7%

Additional rate of vehicle trip production, post-
8:00 AM period vs 7:00 to 8:00 = 84.9 - 70.8 = 14.1 per 100

Additional Vehicle Trips:

14,000 x .127 x .141 = 251 vehicle trips

Of course, there are a variety of factors that determine the method of travel that an employee will choose, and it is unreasonable to project that the mere act of traveling later means that the employee is going to drive alone. However, without any policy that promotes flexible work hours as a mechanism to encourage employees to use higher occupancy modes, the tendency as shown in the data would be to drive alone.

Another factor that has the same type of weak but interesting causal relationship is location of the employee's residence. Because virtually all of the tenants at Bishop Ranch relocated their operations from elsewhere in the region (typically from San Francisco area), many employees suddenly found themselves with very long commutes. To a considerable extent, this distance acted as an incentive for relocated employees to seek a ridesharing or transit alternative to a very long drive to work. Over time, two things have happened: some employees have relocated their residence to be closer to work; and there has also been attrition in the staff, as labor pools closer to the park have taken over some of the new jobs. The net effects are that (1) the average commuting distance of employees has decreased, and (2) rates of driving alone have increased as more employees now reside within 5 miles of Bishop Ranch, where carpooling is not presently advantageous nor is transit service generally available.

Listed below are data that describe these trends toward close location.

Distance of Employees from Bishop Ranch
(percent of employees)

Distance	**1986**	**1987**	**1988**
under 5 mi.	18.1%	20.9%	23.1%
6 to 10 mi.	8.5	9.3	7.9
11 to 20 mi.	40.7	40.4	41.5
> than 20 mi.	32.7	29.4	27.6
Avg. Trip Length (in miles)	15.2	14.6	14.3

If nothing else had changed during this measurement period, i.e., persons also changing their mode of travel, these data would suggest a positive trend in reduced trip lengths, translating to fewer vehicle miles of travel (VMT). Weighting the distance groups at the midpoint of their ranges (over 20 miles represented by 25 miles) produces an estimate of an average trip length of 15.2 miles in 1986, falling to 14.6 miles in 1987, and then to 14.3 miles in 1988.

However, this shift in trip length was also accompanied by important changes in mode choice, as illustrated in the following table:

Modal Use by Distance to Work

	0 - 5 miles			6 - 10 miles			11 - 20 miles			21+ miles		
	'86	'87	'88	'86	'87	'88	'86	'87	'88	'86	'87	'88
Drive Alone	77%	84%	86%	70%	84%	81%	57%	69%	74%	36%	44%	48%
Carpool	17	12	9	25	15	16	28	20	16	30	24	23
Vanpool	0	0	0	1	1	1	4	4	5	19	23	23
Transit	0	0	0	0	0	2	9	6	4	15	8	4
Other	4	4	5	4	0	0	2	1	1	1	1	1

These data illustrate that the rate at which employees drive alone increases directly as the distance to work becomes shorter. The tendencies toward all ridesharing modes increases with distance from work, and becomes particularly attractive outside of 10 miles. The data also illustrate that these trends are becoming more pronounced over time, i.e., the closer an employee lives to work, the higher the percentage which drove alone in 1988 than did in 1987 or 1986.

These distributions of mode of travel vs. distance from work correspond to the following rates of vehicle trip production:

Vehicle Trips per 100 Employees

Distance	**1986**	**1987**	**1988**
Under 5 miles	83.8	88.8	89.6
5 to 10 miles	80.1	90.1	87.5
11 to 20 miles	68.8	77.5	80.9
Over 20 miles	50.1	55.8	59.2
Average VMT	9.2	9.9	10.2

If these trip production averages are applied to the distribution of employees in the various distance categories, and the result is weighted by the mean trip length of the category, the average Vehicle Miles of Travel (VMT) per employee in each year can be estimated. This calculation shows that average VMT per employee has increased steadily between 1986 and 1988, despite the fact that closer location has meant that average trip lengths have *declined* steadily through the same period.

Some interesting "what if" challenges can be made to the current vehicle trip rates using the above data.

- If 1988's travelers comprised the same geographic distribution as those in 1986, with the 1988 modal splits, they would generate 75.9 vehicle trips per 100 employees, instead of the 77.6 observed. On a base of 14,000 employees, this means (77.6 - 75.9) x 14,000 = 238 fewer daily vehicle trips made.

- If 1988's travelers comprised the same modal split distribution as those in 1986, but 1988's geographic distribution, they would generate 68.1 vehicle trips per 100. With the 1988 employment base this would mean (77.6 - 68.1) x 14,000 = 1330 fewer vehicle trips.

- If 1988's travelers comprised both the same geographic and modal split distribution as 1986, they would generate 66.9 vehicle trips per 100. With the 1988 employment base, this would mean (77.6 - 66.9) x 14,000 = 1498 fewer vehicle trips.

From this analysis of the link between geographic location, mode choice and trip reduction, several conclusions can be offered. It is ironic that, while having the workforce locate closer to the employment site should result in improved travel conditions, in reality, living closer also seems to be correlated with a greater tendency to drive alone. Therefore, what is seen at Bishop Ranch is a higher percentage of persons driving alone, with a net increase in both vehicle trips and vehicle miles of travel. If these closer locations could be translated to higher densities, potentially the relocations could be used to advantage in terms of offering alternatives such as transit.

In summary, the TDM program at Bishop Ranch has achieved an impressive trip reduction, particularly considering (1) the remote location and low density nature of the development and its surrounding area, and (2) the absence of "hard" incentive and disincentive actions, such as subsidies and parking charges. Restricted parking at some of the major employment sites seems to have an important effect on employee use of high occupancy modes. Also important is the aspect of strong employer concern and support of alternative commute and relocation assistance programs for employees who were inconvenienced by their company's relocation to such an outlying location. The long commute distances facing many employees has acted to encourage high ridesharing rates. However, over time, resettlement and attrition has brought the workforce closer, and whether as a result of the closer distance or readjustment to travel conditions, rates of single occupant commuting have increased. Similarly, employees have been offered flextime privileges, as a means of reducing the number of vehicle trips in the peak hour. Initial evidence suggests a shifting of trip making, but, while there has been some reduction of the peak, the evidence shows

primarily a shifting of the peak by about a half hour later into the day, and higher rates of drive alone usage both outside and within the peak hour.

The results achieved at Bishop Ranch are nevertheless impressive for a modern, low-density office park. The lack of time stability in the trip reduction rates will require continued monitoring to ascertain whether there are program factors that are contributing to the divergence from goals or which can be used to return performance toward the goals.

4. INDIVIDUAL PROGRAM EFFORTS

While each employer in the park can be credited with a vehicle trip reduction, some have achieved a decidedly higher rate of performance than others. Discussed below are the details on one program which has been exemplary in its success in reducing vehicle tripmaking.

Pacific Bell

Pacific Bell has the largest single installation in the park. The facility, known as the San Ramon Valley Administrative Center, is a 1.7 million sq. ft. building located on a 100 acre site in the center of the park. The company employs about 6900 individuals, mostly in service, clerical and administrative functions.

Pac Bell was one of the early tenants at Bishop Ranch, beginning its occupancy in January 1985. Virtually all of its employees were relocated from the company's former offices in San Francisco. The massive relocation occurred within a relatively short 6-month period. The scale, suddenness and the distance of the move meant that the company had to make special efforts to assist its employees make the adjustment to the new site, particularly since many were facing extremely long commutes. It appears that the concentration of the move may have made certain of the TDM program elements even more effective.

The company offered an extensive relocation assistance program to its employees which included retention of a full-time, on-site transportation coordinator to assist in identification of alternatives, a rideshare matching program to assist in the formation of carpools and vanpools, establishment of a vanpool program, and contracting with the County Connection for shuttle service to the BART station at Lafayette. A flextime program was instituted, and Pac Bell also offered special assistance to hardship cases with difficult commutes in relocating their residences closer to the park.

While many of the employees were interested in forming carpools or vanpools simply to reduce the burden of the long commute, the company provided an additional discouragement to driving alone to the site by placing strict limits on its parking supply. When Pac Bell furnished its plans for the new building, those plans included surface parking for only 4600 vehicles. This is only 2.7 spaces per 1000 square feet, which is quite low for this type of development. This is also a ratio of 1.5 employees per space.

The motivation in limiting its parking was primarily cost related, since that was really all the surface parking that could be accommodated at the site. However, the company was also placed under a 40% peak period vehicle trip reduction requirement by Contra Costa County as a condition of its building permit. It believed it could make the space ratio work with the appropriate management program.

Pac Bell has had and continues to have the best trip reduction program in the park, as shown by the modal split rates listed in the following table:

Pacific Bell TDM Program Results
Employee Modal Split and Trip Generation Rates

	1986	1987	1988
Travel Mode			
Drive Alone	48%	59%	63%
Carpool	32	26	22
Vanpool	9	11	11
Transit	6	3	2
Other	5	1	2
Vehicle Trips per 100 Employees*	61.8	70.4	72.8
Avgerage vehicle Occupancy	1.54	1.41	1.35

* assumes 2.5 persons per carpool and 30 persons per transit trip

Pac Bell's initial program efforts in its first year, 1986, resulted in only 48% of its employees coming to work by single-occupant vehicle; the majority came to work by other means, mostly (32%) by carpool. Over the next two years, the drive alone rate has gradually increased, with currently 63% of all employees driving alone. Both carpool and transit use have fallen accordingly, while vanpool usage has increased somewhat.

Exactly why the rate of use of high occupancy modes has fallen is not clear, although even at the present rate of trip reduction, the Pac Bell program has an impressive result. In the table below, the Pac Bell results are compared to three standards: The next largest employer in the park, the rest of the park with these two large employers excluded, and the regional control sites (Walnut Creek and Santa Rosa) presented in the previous section.

Pacific Bell TDM Trip Reduction Comparisons

	Pac Bell	**Company "B"**	**Remaining B.R. Park**	**Region Average**
Travel Mode				
Drive Alone	63%	73%	80%	
Carpool	22	13	12	
Vanpool	11	10	3	
Transit	2	2	4	
Other	2	2	1	
Vehicle Trips per 100 Employees*	72.8	79.1	85.2	93
Average Vehicle Occupancy	1.35	1.24	1.16	1.07
Eff. Vehicle Trips @ Pac Bell	5023	5458	5879	6417
Trips Reduced		435 (8.7%)	856 (17.0%)	1394 (27.8%)

* assumes 2.5 persons per carpool and 30 persons per transit trip

From these comparisons it is concluded that the efforts of Pac Bell's program, compared to the most direct competing company in the park in terms of size and function, reduces 435 more vehicle trips, or 8.7%, than would the comparable efforts of the Company "B". Compared to the rest of the park without the two large employers included, Pac Bell's efforts reduce 856 more trips, or 17%, than the efforts of these organizations. Finally, compared to the average for the region, the Pac Bell program reduces 1394 trips, or 27.8% more than would be expected to occur at other comparable locations in the region.

Why Pac Bell's program has diminished in effectiveness over time is not known. Clearly more employees are deciding to drive alone. This is probably due to residential relocation, time of day changes, and other factors. What is suggested by the above analyses is that the number of vehicle trips now being generated, 5023, exceeds the 4600 spaces that are available at the site. It is believed that these vehicles are parking at other locations in the park. It is also known that statistically, an average of only about 85% of an employment force appear at work on a given day, meaning that the effective demand of these 5023 vehicle travelers would only be 5023 x .85 = 4270.

8. CASE STUDY: HACIENDA BUSINESS PARK

PLEASANTON, CALIFORNIA

1. SITE DESCRIPTION

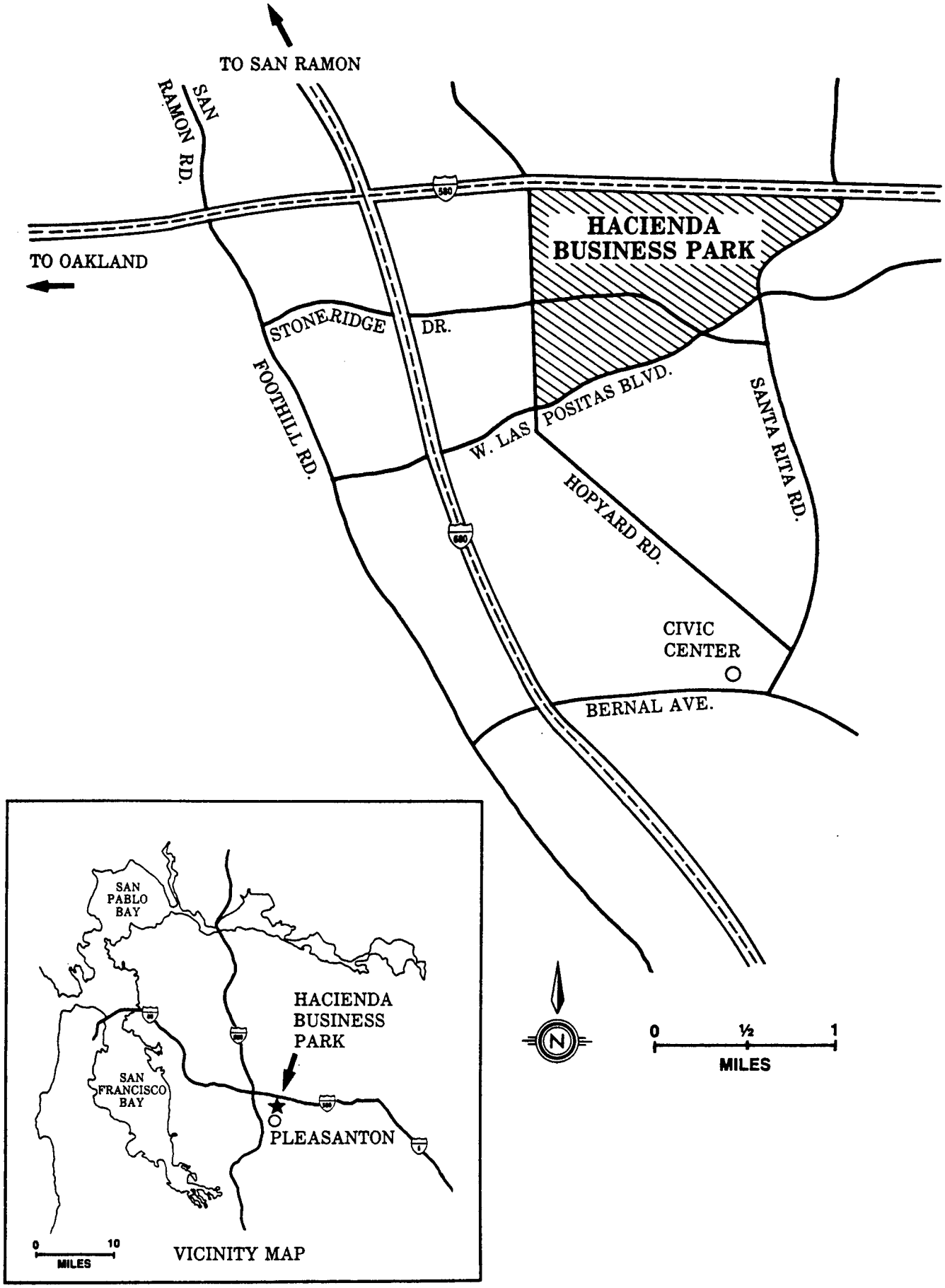
Location and Character of Site

Located 32 miles southeast of downtown San Francisco, in the "Tri-Valley" area, Pleasanton was first an agricultural community and then a "bedroom" suburb of San Francisco. As shown in Figure 1, Pleasanton is located just south of San Ramon and the Bishop Ranch Business Park, at the intersection of two regional freeways, I-580 and I-680.

The current population of Pleasanton is over 40,000 residents. The trend over the past 20 years reveals a steady increase in population, slowing after the advent of Proposition 13 in California and the implementation of a growth management program in Pleasanton for new housing in the early 1970's:

Year	Population
1970	18,328
1975	31,667
1980	35,160
1985	39,924

At about the same time that the City of Pleasanton chose to limit residential growth, which it feared might overburden the city's ability to provide services, the City began pursuing opportunities for commercial development. Such development was viewed as being able to expand the local tax base while not being a drain on the city's services. Thus, as of 1984, almost 14 million square feet of office, light industrial and retail development had been approved in Pleasanton. This translated into significant increases in employment. 1980 employment in Pleasanton was 8,774, while 1987 levels have swelled to approximately 22,289. Thus, while the population is only growing by approximately two percent per year, employment has more than doubled in the past eight years. The Association of Bay Area Governments (ABAG) project that, between 1980 and 2000, four new jobs will be created in Pleasanton for every new household in the city. In fact, the same projections estimate that the jobs-to-housing ratio will shift from 0.81:1 to 1.86:1 from 1980 to 2000.



PLEASANTON, CA

FIGURE 1

Transportation Facilities

Traffic conditions on the two freeways serving Pleasanton (I-580 and I-680) and on local streets are still relatively uncongested, especially as compared to other parts of the Bay Area. These freeways operate at 75 - 80% of capacity during the peak hour and local intersections largely operating at LOS C or better. Between 1987 and 1988, average daily traffic (ADT) volume increased by 10%, from 844,000 vehicles per day to 928,000. Overall, traffic conditions stayed about the same during this period. As measured by Level of Service at 37 major intersections throughout the city, nine intersections improved, six worsened and 22 remained the same during the a.m. peak period. In the evening, 14 intersections improved, seven worsened, and 16 remained the same.

Clearly, however, increases in employment will outpace the ability of the public and private sectors to accommodate all this new demand by improving the local and regional roadway network. Efforts to reduce the overall number of vehicle trips generated by this new development via traffic mitigation programs were foreseen. In 1983, the Tri-Valley Transportation Study concluded that with new development, traffic volumes would increase to unacceptable levels and that peak hour vehicle trips would have to be reduced by as much as 45% to maintain "reasonable" levels at full development.

Since future phases of development were contingent on maintaining certain traffic conditions in the area, and the assessment district would apply to all development, the developers of the Hacienda Business Park pursued the expansion of the TSM requirements city-wide via an ordinance. Concurrently, a citizen's General Plan Review Committee, noting that most transportation studies in the area called for significant use of flex-time and commute alternatives to maintain tolerable traffic levels, also called for a city-wide TSM ordinance. City staff drafted the ordinance with substantial input from area employers and developers.

The TSM ordinance was adopted in October 1984. The ordinance is tied to both peak hour trip reduction and intersection LOS goals. The ordinance applies to new and existing employers and multi-tenant buildings. For employers with 10-49 employees, some informational requirements are called for, but more extensive requirements are placed on employers with 50 or more employees and groups of employers in multi-tenant buildings.

The ordinance calls for the designation of an employee or complex coordinator and the development of a transportation management program to reduce the number of trips arriving in the peak hour by 45% over the hypothetical level defined above. "Any reasonable combination of TSM measures" can be used to achieve the target, including commuter alternatives and changed work hour programs. The ordinance calls for compliance with the 45% target in four years, with a 15% reduction the first year and a 10% reduction in each subsequent year. An annual employee survey, part of the annual reporting requirement, and separate plan are required by the City and are designed to report on progress in the previous year and update plans for the following year.

A transportation coordinator was hired by the City to oversee the provisions of the ordinance and collecting intersection and employee survey data and employer annual reports. The City is ultimately empowered to levy fines for not complying with the

reporting requirements or implementing the measures in a plan. Finally, the City can prescribe mandatory TSM measures on employers and complexes. As a check, however, a peer review group, called the TSM Task Force was formed among area businesses to monitor compliance with traffic and transportation management requirements.

The results of Pleasanton's ordinance after four years reveals some unexpected trends in terms of mode split, while at the same time meeting its peak hour target. For the city as a whole, the drive alone rate has increased from 1985 to 1988. In 1985, the first year of the ordinance, 81% of Pleasanton workers drove alone to work. According to the annual required survey, this had increased to 84% and 86% during the next two years, respectively. Finally, the drive alone rate for 1988 began to fall again, and was 84%. Regional mode split estimates for suburban employment is consistent with these alternative mode splits of 15 - 18%. This five percent shift (as seen in the figure below) in 1985 - 1987 mode share occurred at a time when employment increased by 65%, from 13,549 to 22,289.

It should be noted, however, that most of the 45% reduction in peak hour traffic was expected to come from flex-time and other alternative work hour programs that would shift travel outside the target peak hour (7:30 - 8:30 a.m.). During the same period, the proportion of commuters traveling to work during the a.m. peak hour decreased city-wide from 56% in 1985 to 51% in 1988, even with the increases in employment and the drive alone rate. Therefore, Pleasanton achieved its targeted peak hour trip reduction by moving commuters out of the morning peak hour and not by shifting commuters into high occupancy or non-motorized modes. The city-wide changes in mode split and peak hour commuting are summarized below:

Year	**1985**	**1986**	**1987**	**1988**
Drive Alone Rate	81%	84%	86%	84%
Commuting During Peak Hour	56%	58%	53%	51%

2. BACKGROUND AND MOTIVATION FOR TDM PROGRAM

Hacienda Business Park

Approximately half of the approved 14 million square feet of development in Pleasanton will occur within the Hacienda Business Park, located in the northern part of Pleasanton, at the intersection of the two freeways. Phase I, with construction beginning in 1981, calls for some eight million square feet of office, light industrial, hotel and retail uses. The master planned development will ultimately consume 763 acres and employ 35,000 employees within 11.7 million square feet. There are currently over three million square feet of development on the ground with some 9,800 employees. The business park's existing major tenants include: AT&T (2,930), Associates National Bank (550), EG&G Energy (212), and many employers with 100-200 employees.

In 1982, in response to plans for this major development, the City of Pleasanton rezoned a parcel of land from an industrial classification to a Planned Unit Development, making way for the Hacienda Business Park. After a challenge to the environmental documents and the passing of a local referendum, the PUD process moved ahead and some 110 requirements were placed on the phased development. The two major traffic-related requirements were the creation and implementation of a transportation management program to reduce the number of vehicle trips and contributions toward roadway improvements through an assessment district. This later requirement lead to the establishment of the North Pleasanton Improvement District. Funds collected ($110 million) through this mechanism will pay for streets, sound walls, freeway interchange improvements, a computerized traffic signalization system, and other needed improvements. These improvements are geared toward a goal of maintaining a peak hour level of service (LOS) "mid-D" at all adjacent intersections on arterials and freeways.

The PUD requirements also called for a TSM program for all owners and lessees. A goal was established of reducing the number of a.m. peak hour trips by 45% over levels that assume all commuters arriving during the peak hour by single occupant vehicles. Subsequent phases of development would be contingent on meeting these traffic goals.

The Hacienda Business Park Owners' Association was established to oversee the operation and maintenance of the park and assure compliance with the PUD requirements. One function of the Owners' Association is to serve as a Transportation Management Association to assist owners and tenants in developing and implementing their transportation management programs and provide services available to all employees in the park. The Owners' Association also reviews new building designs to assure compliance with city guidelines that call for five percent of all parking to be designated as preferential spaces for carpools and vanpools and enough bicycle parking to serve 3.5% of the building's population.

The Hacienda Business Park Owners' Association (HBPOA) initiated a transportation management program in April, 1984. It was designed to implement many of the PUD requirements placed upon the development during project approval. The developers, Callahan-Pentz Properties and Prudential Insurance Company of America had previous experience in transportation management programs, having established a program at Moffett Park in Santa Clara County, CA.

The Hacienda Business Park transportation program originally consisted of two staff members overseeing services to tenants and building managers within the park as well as a shuttle system for peak hour service to a nearby BART station and a noon-time internal circulation system. The HBPOA provided computerized matching for carpools and vanpools and promoted commute alternative through new tenant orientations, promotions and a company coordinators' network.

The program currently provides passes to employees of the business park for the BART Connection, assists employers with their in-house programs, facilitates the company

coordinator network, and promotes the program through the Owner's Association newsletter. Owners pay dues to the association and this funds the transportation management activities.

The TSM Task Force has played an active role in assisting employers and complexes with compliance. The Task Force produced "TSM Made Easy: A Guide for Multi-tenant Managers" which was distributed to all buildings in the city that need to comply. The Task Force also helped mitigate a growing traffic problem at a critical intersection. The intersection had degraded to LOS "E" during the p.m. peak hour. The City determined that 600 trips needed to be reduced to bring the intersection up to LOS "D". A committee of the TSM Task Force was formed of the employers and complexes that used this intersection and developed refined TDM strategies to solve the problem. The City was empowered to create an assessment district to improve the intersection, but first choice to work cooperatively with the business community to find a transportation management solution. The combination of opening a new interchange in the area, and reducing 599 trips through TDM, contributed toward bringing the intersection back to LOS "D".

3. OVERALL EFFECTIVENESS OF PROGRAM

The effectiveness of the Hacienda Business Park TDM program is revealed through two sources. First, the annual surveying requirements of the city reveals that the drive alone rate at Hacienda Business Park has remained fairly static, if not increased slightly. The drive alone rate in 1986 was 77.1%; in 1987 it was 79.8%; and in 1988 it was 78.7%. One explanation for this slight shift back to driving alone was the fact that commute distances were becoming slightly shorter at the same time, as illustrated in the table below. Average trip length decreased from 15.1 miles in 1986 to 14.6 miles in 1988. Since trip distance is often correlated with mode choice, shorter trip distances, partially caused by workers moving closer to their Pleasanton jobs, translated into more commuters choosing to drive alone.

Distance of Employees from Hacienda Business Park
(percent of employees)

Distance	**1986**	**1987**	**1988**
< 5 miles	23.9%	23.9%	25.0%
6 to 10 miles	15.7	16.5	16.6
11 to 20 miles	20.0	20.3	20.0
> 20 miles	40.5	39.3	38.4
Avg. Trip Length (in miles)	15.1	14.9	14.6

The carpool and transit (local bus and BART connection) rates remained fairly constant as well, at around 16% and 2.3% respectively. Indeed, the alternative mode that seemed to garner more interest over time was vanpooling, although the proportion is still small, increasing from 1.2% in 1986 to 1.9% in 1988. However, since 7,700 employees work in Hacienda Business Park, this would correspond to 150 vanpool riders and 10 vans serving the employment center. The following table summarizes the travel mode characteristics of Hacienda Business Park employees for the three years with available data:

Travel Mode	**1986**	**1987**	**1988**
Drive Alone	77.1%	79.8%	78.7%
Carpool	16.2	14.6	15.8
Vanpool	1.2	1.7	1.9
Transit *	3.0	2.5	2.3
Other **	2.5	1.4	1.2

* Local transit, BART connection, club bus

** Bicycle, walk, drop-off, motorcycle, other

Traffic, however, does not seem to be suffering as a resulting of employment growth nor a consistent drive alone levels. Of the seven intersections monitored between 1987 and 1988 in or adjacent to Hacienda Business Park, all but one operate at LOS "A" or "B". In most cases the volume to capacity V/C ratio remained the same or improved. The one intersection (Hopyard/I-580) that was operating at LOS "D" with a V/C ratio of 0.90 was improved to LOS "C" with a V/C ratio of 0.74. A major interchange is being constructed on I-680 near Hacienda Business Park which will further alleviate traffic congestion at the access points from I-580. Vehicle occupancy for the North Pleasanton area is 1.14 during the p.m. peak hour and the 16 sites surveyed through driveway counts revealed a low occupancy of 1.05 to a high of 1.29. The counts also revealed a p.m. trip generation rate of 1.24 vehicle trips per 1,000 square feet of office space. This is well below the standard of 2.0 traditionally used by the city.

What probably accounts for the ability of Hacienda Business Park to hold the line on traffic conditions is the city's emphasis on flexible work hour programs to move trips out of the a.m. peak hour (7:30 - 8:30 a.m.). In 1988, the proportion of Hacienda Business Park bound commuters that arrived in the a.m. peak hour was 63%. Each year this proportion has decreased. The fact that one third of the workers were arriving before and after this peak hour contributed to the ability to maintain uncongested roads.

Referring to data presented in Table 1, Hacienda Business Park's TDM program seems to have met the city's trip reduction requirement. If it is assumed that each carpool carries 2.5 riders, each vanpool 12 riders, and each bus 30 riders, it is estimated that Hacienda Business Park employees generated85.2 daily one-way vehicle trips per 100 employees in 1988. This corresponds to a 1.17 vehicle occupancy average. This means that the employee population of 7,769 produces about 6,623 daily vehicle trips. Of these trips, 63% or 4,172, occur in the a.m. peak hour (7:30 - 8:30 a.m. as defined by the ordinance). Therefore, from the combination of shifting some employees to higher occupancy modes and others to travel outside the peak morning hour, the Hacienda Business Park can be credited with a 46.3% (7,769 - 4,172/7,769 = .463) reduction in peak hour vehicle trips over the situation where every employee would drive alone during the morning peak hour. Based on the city's 45% peak hour trip reduction requirement, Hacienda Business Park has meet the goal within the specified four year period.

This comparison, however, is made against a hypothetical situation whereby every commuter would be driving alone. Indeed, some percentage of commuters would naturally be using alternatives to driving alone even without a formal TDM program. It is the difference between this "background" rate of vehicle trip generation and that induced by the TDM program that constitutes the trip reduction directly attributable to the formalized transportation management effort. As a basis for comparison, three other areas were selected so as to assess the mode split and trip production rates in contrast to those for Hacienda Business Park. The table below compares Hacienda Business Park to Pleasanton as a whole, to Walnut Creek (another suburban growth center) and to Santa Rosa (an existing smaller city developing into a high growth center).

Applying the occupancy factors utilized throughout this report, Hacienda Business Park is estimated to generate 6,623 trips among its 7,769 employees, or 85.2 trips per 100 employees. This is 3.5 trips per 100 less than for the city as a whole, and is considerably lower than for the other suburban activity centers used as comparisons in the table. However, if Hacienda Business Park were to generate vehicle trips at rates equal to that for the city as a whole, the center would generate 6,891 trips, or 268 more than with its TDM program, translating to a 4% trip reduction attributable to the program.

If the two other locations, Walnut Creek and Santa Rosa, are used as reference points for commuting behavior in the absence of a TDM program, then the Hacienda Business Park program may have reduced 606 vehicle trips, for an 8% reduction over "background" levels, calculated as follows:

Hacienda Business Park Vehicle Trip Rate = 85.2/100

Vehicle Trip Rate for Control Sites = 93/100

Rate Differential: 93 - 85.2 = 7.8/100

Total Reduction: 7,769 x 7.8/100 = 606 Vehicle Trips

TABLE 1

COMPARATIVE TRAVEL CHARACTERISTICS
HACIENDA BUSINESS PARK

	HBP	Pleasanton	Walnut Creek	Santa Rosa
Travel Mode				
Drive Alone	78.7%	84.3%	89.9%	91.3%
Carpool	15.8	10.8	6.9	4.7
Vanpool	1.9	0.7	0.5	0.1
Transit	2.3	1.6	2.6	1.4
Other	2.5	1.3	0.1	2.5
Vehicle Trips per 100 Employees *	85.2	88.7	92.8	93.2
Average Vehicle Occupancy	1.13	1.17	1.08	1.07

* Assumes 2.5 persons per carpool,
12 persons per vanpool, and
30 persons per transit trip

4. INDIVIDUAL PROGRAM EFFORTS

As a means to show the variety of employer programs, both within Hacienda Business Park and other parts of the city and to compare firm results with the results for the Business Park and the city as a whole, five employer programs were examined. Each is described below, along with some revealing statistics on the firms' ability to induce commuters to change their travel behavior. Finally, a comprehensive comparison is made, based on mode split and peak hour arrivals, between these programs and comparable statistics for Hacienda Business Park and the city as a whole. The five companies are: AT&T and Sun Diamond Grower's located within the park, and Payco General American Credits, Farmers Insurance, and the Clorox Technical Center located outside the park.

Firms Within Hacienda Business Park

AT&T

In the early 1980's, AT&T moved its West Regional Operating Center to Pleasanton and leased space in a number of buildings throughout Hacienda Business Park. When it consolidated its operation into a single site, parking became a key issue. AT&T's employees in San Francisco had generally paid for parking as a corporate-wide policy precluded sites from leasing spaces outside those provided as part of floor space leases. In suburban settings such as Pleasanton, AT&T knew that abundant surface parking would be provided. They negotiated with the city and the developer to build less than required parking because of their anticipated TDM program. The Covenants, Codes and Restrictions for Hacienda required tenants to implement trip reduction measures. The city's requirement would have meant some 4,000 spaces be built at the new site. AT&T convinced the city that their required TDM program would mean that 25% of AT&T's employees would commute to work by means other than driving alone. Therefore, the city agreed to 2,950 parking spaces for an ultimate employee population of 3,890. The site now employs closer to 3,300 employees, which is still higher than the parking supply. Therefore, AT&T purposely sought reduced parking in the face of the TSM requirement and with the confidence that they could maintain a 25% use of modes other than driving alone.

In 1988, AT&T had 3,890 employees, making it the largest employer in Pleasanton, consolidated in a complex of six buildings that the firm developed with 1.1 million square feet of office space. AT&T's program consists of rideshare promotion and matching. AT&T had used the matching services of the Hacienda Business Park Owners Association, but in the absence of that service has begun doing their own in-house matching next year. Some 280 preferential parking spaces are provided for 300 carpools and 12 owner-operator vanpools. Flex-time allows employee arrival anytime between 5:00 - 9:00 a.m. AT&T was a strong supporter of the citywide ordinance and was instrumental in establishing the TSM Task Force.

AT&T's program meets the city requirements by having high carpooling and vanpooling rates and by shifting a significant proportion of its employee arrivals outside the peak period. The mode split and arrival statistics for 1986 and 1988 are revealed in the table below (data for 1987 are not included because of low response rate):

AT&T MODAL SPLIT

Travel Mode	1986	1988
Drive Alone	70.5%	71.3%
Carpool	21.2	21.8
Vanpool	1.8	3.2
Transit	3.0	2.4
Other	2.3	1.0
Percent in a.m. peak hour	61.8%	55.5%

As the data indicate, AT&T has a strong carpool program, a growing vanpool program (51% of the employees live 16 or more miles from work), and has met the city requirement of moving 45% of the employee arrivals out of the morning peak hour. The average a.m. vehicle occupancy for AT&T is 1.13 (close to the city's average of 1.14), but the a.m. peak hour trip generation per 1,000 square feet of office space is only 1.03, (less than the 1.24 city average) due to the flex-time program. With half of the employment of Hacienda Business Park, AT&T's program has a dramatic impact on the compliance for the entire development.

Table 2 allows a computation and comparison of AT&T's program vs. "background" conditions in the area. AT&T's 3,890 employees generate 3,131 daily one-way vehicle trips, or 80.5 trips per 100 employees. If the mode split for Hacienda Business Park as a whole were considered indicative of typical employer TDM programs, and these proportions were applied to AT&T's employee base, AT&T would generate 3,314 trips, or 183 more than what it accomplishes with its TDM program. This corresponds to a 5.5% trip reduction. Likewise, if AT&T were to generate trips at a rate equal to that of the city of Pleasanton, it would generate 3,450 trips from its 3,890 employees, or 183 more than are presently made under its TDM program; this translates to an effective trip reduction of 9.3%.

Sun Diamond Growers

Located in the Hacienda Lakes complex of Hacienda Business Park, Sun Diamond has 128 employees at the Pleasanton site. Sun Diamond's work schedule for non-exempt employees is 7:45 a.m. - 5:00 p.m. Monday through Thursday and 7:45 a.m. - 12:45 p.m. on Fridays. Sun Diamond provides rideshare matching through the regional commute management organization, RIDES. It also provides preferential parking spaces for poolers, company cars for mid-day business use and a guaranteed ride home program for emergencies. Sun Diamond's drive alone rate has dropped from 82.4% in 1986 to 77.2% in

TABLE 2

SUMMARY OF EFFECTIVENESS OF TDM PROGRAMS

PLEASANTON - HACIENDA BUSINESS PARK

(1988 Commute Statistics)

	City	HBP	AT&T	SD	PC	FI	CL
Travel Mode							
Drive Alone	84.3%	78.7%	71.3%	77.2%	49.5%	79.4%	78.5%
Carpool	10.8	15.8	21.8	19.3	33.0	19.0	19.6
BART/Bus	0.9	1.4	0.9	0	12.0	0.7	0.2
Transit	0.7	0.9	1.5	0	5.5	0.2	0
Vanpool	0.7	1.9	3.2	2.6	0	0	0
Bicycle	0.8	0.4	0.4	0	0	0	0.2
Walk	0.8	0.3	0.3	0.9	0	0.2	0.2
Motorcycle	0.4	0.2	0.2	0	0	0.5	0
Other	0.5	0.2	0.2	0	0	0.5	0
Percent a.m. peak hour	51%	63%	55%	76%	66%	86%	61%
Employees	22,000	7,769	3,890	128	112	705	450
Vehicle Trips Per 100 Employees *	88.7	85.2	80.5	85.2	63.4	87.0	86.2

Employer Code:

HBP = Hacienda Business Park
SD = Sun Diamond Growers
PC = Payco
FI = Farmers Insurance
CL = Clorox Technical Center

* Assumes 2.5 persons per carpool
12 persons per vanpool, &
30 persons per transit trip

1988. Carpooling increased over the same period from 14.7% to 19.3% and vanpooling from 1.0% to 2.6%. Morning peak hour arrivals constitute 76.5% of Sun Diamond's total arrivals, and this is well above the average for Hacienda Business Park of 63% and 51% for the city as a whole. However, the combination of Sun Diamond's and neighbor Spreckels Sugar's high carpooling rates contributes the fact that the Hacienda Lakes complex has a a.m. peak hour vehicle occupancy of 1.29, but generates 1.82 trips per 1,000 square feet during that period.

Firms Outside Hacienda Business Park

While many firms within the Hacienda Business Park,and the HPBOA, have produced impressive results, several firms with very impressive results can be found outside of the business park. This is partially due to the fact that the ordinance applies to all employers within the City of Pleasanton. For example, Farmers Insurance Group of Companies has only achieved 26% of its needed TSM goal of 45% fewer employees driving alone during the morning peak hour. Its carpooling rate (19% in 1988) is higher than that for the city of for Hacienda Business Park, but its set work hours policy means that 85% of its employees arrive between 7:45 and 8:45 a.m.

Clorox

Clorox Technical Center has a similar carpool rate of 19.6% in 1988 and this number is down from 23.8% in 1986. However, in 1988 the firm instituted staggered work shifts beginning at 7:00, 7:30, and 8:00 a.m., which resulted in the number of employees arriving in the city's targeted peak hour dropping from 90% to 61%.

Payco General American Credits

Payco, with 112 employees, is new to Pleasanton, having relocated from some distance, but has achieved impressive results via flex-time and an aggressive TDM program. The company's flex-time program allows employees to work flexible schedules M-F and on half-days Saturday. The firm intends to implement a 4/40 work week next year. Preferential parking for pools and bicycle parking is provided. In 1988, only 49.5% of Payco workers drove alone to work, while 33% carpooled, 12% used BART and its bus connection, and 5.5% used other transit. Only 66% of Payco workers arrived from 7:45 - 8:45 a.m. and the flexible schedule seemed to have no detrimental impact on ridesharing or transit use. One explanation for Payco's success in maintaining high commute alternative rates is the fact that 73.4% of its employees live 16 miles or more from work.

Overall Comparison

Comparing these five employer programs to that for Hacienda Business Park and the city as a whole reveals a considerable amount of information on the city's ability to garner a variety of programs, yet still meet its areawide peak hour reduction.

Even with impressive diversion of commuters to periods outside the critical a.m. peak hour, the trip production rates and overall trip reduction impacts (for all daily commute trips) is indicative of high drive alone rates and low vanpooling and transit usage.

Given the number of commuters who travel to work outside the a.m. peak hour, and the fact that most intersections operate at or above LOS "C", Pleasanton seems to have accomplished its stated objective of reducing a.m. peak hour trips. However, in the meantime, the proportion of drive alone commuters has been increasing and with it a general increase in trips and trip-making rates over 1985 levels.

This raises the question of whether flex-time is a long-term or only a temporary solution to traffic generation. Clearly flex-time can address site access problems by relieving peaking problems, but its ability to address areawide mobility issues is not clear. What is clear is that had Pleasanton employers and developers done nothing, traffic would indeed be worse in the a.m. peak hour. However, if a comprehensive TDM program aimed at shifting commuters out of drive alone modes altogether had been implemented instead, overall trip making levels might have been curtailed, with the result of relieving congestion throughout the day and perhaps on longer-term basis. The choices an area makes concerning congestion relief depend on many factors, and thus flex-time needs to be considered against a number of other strategies for reducing trips in response to particular or potential problems.

9. CASE STUDY: U.C.L.A.

LOS ANGELES, CALIFORNIA

1. SITE DESCRIPTION

Location and Character of Site

The University of California, Los Angeles (UCLA) campus is located immediately adjacent to Westwood Village, a densely developed urban area in West Los Angeles approximately 10 miles west of downtown L.A. Westwood is a major Southern California activity center. In addition to UCLA, Westwood houses several 20 story office towers, numerous high rise residential complexes, and a growing retail/entertainment center which continues to make the area a popular place to live, shop, work and play.

Approximately 37,000 people live in Westwood, which is bounded by the San Diego Freeway to the west, Sunset Blvd. to the north, Beverly Glen Blvd. to the east, and Pico Blvd. to the South (see Figure 1). Westwood Village is the heart of the community and is situated between Wilshire Blvd. and the UCLA campus. In fact, the intersection of Wilshire and Westwood Blvds. reportedly has the highest 24 hour traffic volume in Los Angeles. Based on its location, Westwood would appear to be a suburban center. However, given its density and proximity to downtown (200,000 employees), Century City (60,000 employees), and the rest of the dense Wilshire corridor, Westwood possesses more the character of an urban center, with a diverse mixture of activities and land uses.

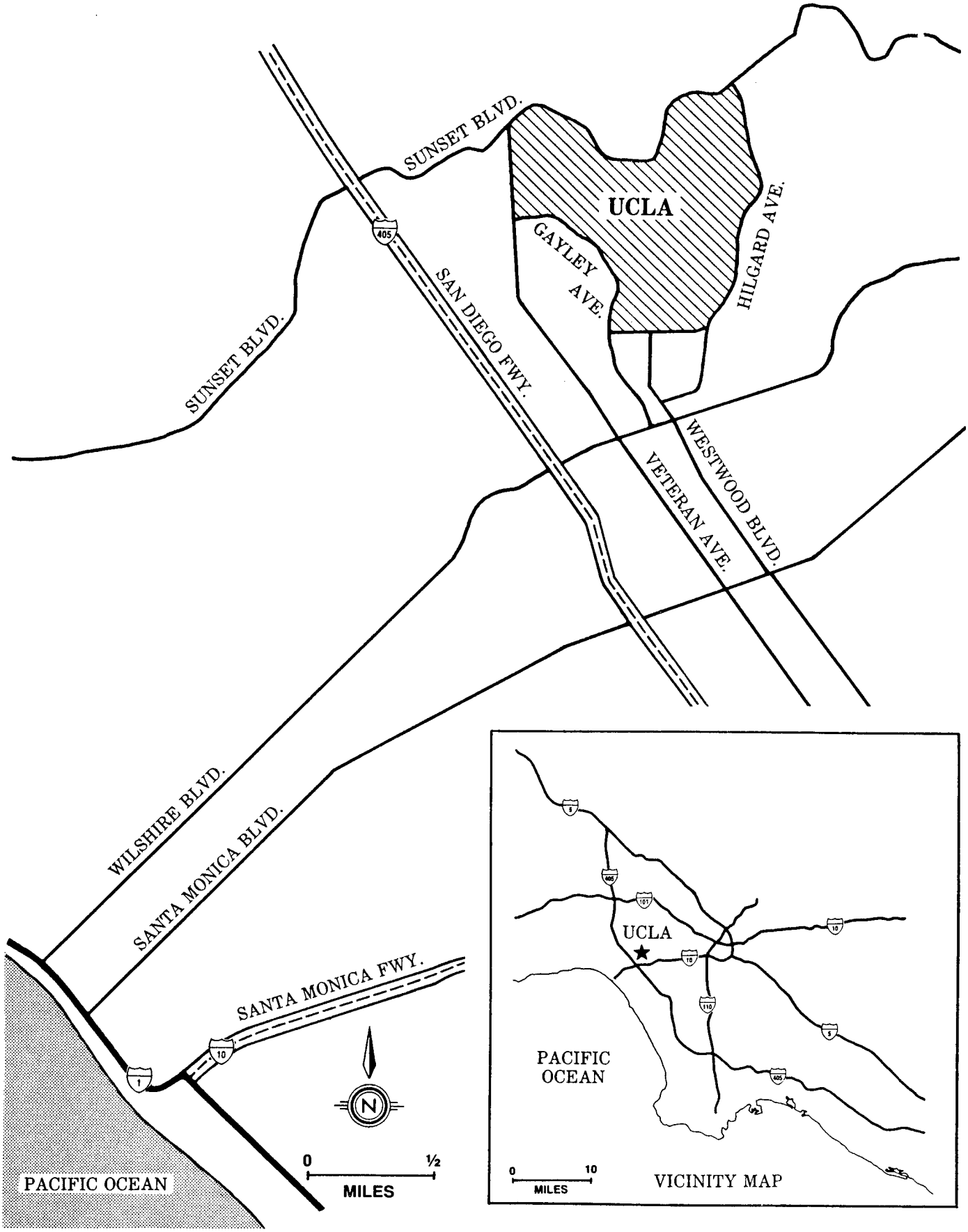
Based on a 1987 environmental impact report for the Westwood Community Plan update, over 21,000 work in Westwood, exclusive of UCLA. Another 18,000 work as faculty and staff at UCLA. Since the Community Plan was updated, two new high-rise office buildings have been completed and another is under construction.

The updated Community Plan (January 1989) has downzoned Westwood, but still allows for considerable growth in employment. At build-out, an estimated 57,000 jobs will be located in Westwood, a 44.5% increase over 1987 levels. The Plan also allows for a population increase of 8,500, a 23% increase.

University of California, Los Angeles

UCLA is the largest campus in the University of California system and the largest university in Los Angeles County. Some 34,000 students attend UCLA and over 18,000 people work on campus. It should be noted that this case study focuses on UCLA faculty and staff, and not on students. Approximately 20,000 university-controlled parking spaces exist on and near campus to serve this total daytime population of over 50,000.

UCLA's employment consists of some 4,000 faculty and 14,000 staff and employees of the Center for Health Sciences (Med Center). This number is not expected to grow significantly in the near term, but even so UCLA is the major employer and influence



WEST LOS ANGELES, CA

FIGURE 1

in Westwood. In fact, the next largest single employer in Westwood is the Federal Building with some 3,000 employees and the largest private employer is Occidental Petroleum with 450 employees. Most of the employment in Westwood is either smaller firms in multi-tenant buildings or smaller retail and other commercial establishments.

UCLA continues to build on campus, even with expectations for stable employment levels. A new housing complex is underway on Northwest Campus, as is a new engineering building. A large medical clinic building is being built in the center of campus and will have a significant impact on traffic, given the expected visitors.

Transportation Facilities

UCLA is located approximately a half mile from the San Diego Freeway (I-405), with access at the southern and northern edges of campus. The Santa Monica Freeway (I-10) is located some three miles south, but the 405 provides the primary freeway access. Several major arterials, providing regional access as well, line the campus, including: Wilshire, Sunset and Sepulveda Blvds. In fact, Wilshire Blvd. is ten lanes wide at Westwood, as wide as the San Diego Freeway at Wilshire.

Transit service to UCLA is among the best in southern California, with 12 lines from three public operators serving Westwood. In fact, UCLA is a major destination for the Southern California Rapid Transit District and a terminus for the Culver City and Santa Monica municipal systems. As will be described below, UCLA also operates its own internal shuttle system (throughout Westwood) and commuter bus service to two areas.

Finally, given the large numbers of students and employees that travel by bicycle, (and other motorized cycles such as mopeds) plans are underway to build an elevated bicycle facility called a Veloway.

Traffic in and around Westwood is severely congested. Westwood streets are overburdened and are expected to worsen. Recent City of Los Angeles Department of Transportation statistics show that within the Westwood Community Plan area, 15 of the 52 intersections operate at LOS "F" during the peak periods. The EIR predicts that by the year 2010, 30 of these intersections will operate at LOS "F", even assuming that a list of eight street widening and improvements will be made. At build-out of the Community Plan area, 38 of these intersections are expected to operate at LOS "F."

A major strategy the City is using to address traffic problems is the collection of traffic mitigation impact fees to pay for, among other physical improvements, the installation of the ATSAC system (Automated Traffic Surveillance and Control system). ATSAC is expected to improve traffic flow by some 15% at intersections and street segments for which it is installed. ATSAC is a computerized traffic control system that will automatically adjust signal timing to compensate for changes in the areawide system of traffic flows. The impact fee system was established as part of the Westwood Specific Plan Ordinance (there are actually several in the area), and calls for a fee of some $5,200 for each p.m. peak trip generated, and has a trip reduction requirement as well.

Traffic entering the UCLA campus has also grown considerably. Based on cordon counts, total daily vehicle volumes had increased by 17% from 1980 to 1985 (95,000 to 111,000). Vehicles entering at the three major entrances increased by 1.5 times more than at other access points. This increase and concentration underscores the traffic congestion situation facing UCLA. Overall, in 1985, the following trip patterns (entering and exiting of students, faculty and staff) were observed:

Vehicles	111,437
Pedestrians	22,129
Two Wheeled	4,386 (12 hours)
Transit	10,878 (12 hours)

Two thirds of the transit riders reaching the campus used one of the three public bus systems, while the remaining third used the UCLA parking shuttles that serve remote lots outside the area's cordon; the shuttle riders, therefore, be better classified as auto users. Inclusive of students, overall vehicle occupancy in 1985 was 1.26 (exclusive of bus passengers, pedestrians, and two wheeled cycles). According to the cordon information, the a.m. peak hour mode split (defined as auto drivers vs. passengers) in 1985 was:

Mode Split of All Persons Entering Campus

Travel Mode	**Number**	**Percent**
Auto Driver	7,056	55.4%
Auto Passenger	1,708	13.4
Bicycles	224	1.8
Motorized Cycles	237	1.9
Pedestrians	2,066	16.2
Bus Passengers	997	7.8
Parking Shuttle	435	3.4
Total	12,723	100.0%

Due to student trips, peaking characteristics are slightly later than for the rest of the region. The morning peak hour, based on 1985 cordon data, is 7:45 - 8:45 a.m. (7.2% of the daily total) and the evening peak is 5:00 - 6:00 p.m. (8.4%). Peak hour traffic volumes have grown very little from 1980 to 1985, while other off-peak periods have experienced much greater growth, indicative of a system nearing capacity. In fact, by 1988, the a.m. peak hour seems to have shifted closer to the 7:00 - 8:00 a.m. hour. A comparison of employee arrival times, based on employee surveys in 1985 and 1988, is presented in the figure below. This information confirms the 7:00 - 8:00 a.m. hour as having the largest concentration of arrivals and shows a slight shift to later arrivals between 1985 and 1988.

Time	**1985**	**1988**
Before 6:00 a.m. or after 10:00 a.m.	7.7%	6.6%
6:01 - 7:00 a.m.	14.8	14.2
7:01 - 8:00 a.m.	45.9	46.8
8:01 - 9:00 a.m.	25.4	26.2
9:01 - 10:00 a.m.	6.2	6.1

Parking fees are charged to all students, staff, faculty and visitors. The monthly/daily fee is $30/$4 respectively, which is well below the market rate in Westwood of $80-$120/$6-$10. Employees are virtually guaranteed a space, and are generally assigned to a lot near their building. Some parking is provided in three peripheral lots, served by shuttle buses, but primarily serves students. Therefore, most employee parking is distributed through the campus in various sized facilities adjacent to buildings. Some employees are eligible for a "blue" permit allowing access and convenient parking at many locations. This is for employees in positions requiring significant intercampus travel. However, with the implementation of the Campus Express shuttle service, more employees are making these trips without their car.

Students also pay $30 per month ($90 per quarter) to park, but vie for a limited number of spaces. A need-based point system is used and student parking is determined by various factors, including: commute distance, tenure, availability of near-by transit, etc. A waiting list several thousand names long exists each quarter. Student carpool permits are provided for carpools of three or more, at a cost of $22, and these commuters are assigned parking first.

In 1985, there were 19,600 available parking spaces on campus, for a combined student and employee population of some 50,000. The maximum accumulation occurs at 11:00 a.m. when 86% of the spaces are filled. The rate of increase in accumulated vehicles is less than a third of the increase in traffic volumes. Again, this is indicative of the peak spreading that is occurring, as increased volumes are being absorbed outside the morning and evening

peak hour. Parking is constrained in many lots as some 1,000 spaces are stacked parking requiring attendants to park cars.

Traffic is a major issue in Westwood, and a very well organized and vocal network of community and homeowner's groups has emerged to bring the issue to the forefront. Growth within the UCLA campus is not controlled by the City, but rather is under the jurisdiction of the U.C. Regents and the State. While UCLA's transportation management program, and its outreach to the rest of Westwood is designed to serve the commuter needs of the campus and its surroundings, it is also clearly a response to the politicizing of the growth and traffic issue and UCLA's desire to remain a responsible community institution.

2. BACKGROUND AND MOTIVATION FOR TDM Program

Prior to 1984, commuter assistance services were provided through the University's Transportation Services office. These services were mainly comprised of annual registration drives, in conjunction with the regional commute management organization, Commuter Computer. Student workers were used to assist Transportation Services staff with the rideshare registration drive and the program was otherwise relatively passive.

In 1984, in conjunction with UCLA's role in the L.A. Olympics, UCLA committed to developing a comprehensive commute management program for UCLA students, staff and faculty. The Commuter Assistance - Ridesharing Office (CAR) was established as a department within the Business and Transportation Services Administration. The CAR Office currently has a staff of 13 full-time equivalents (plus student assistants) and has won numerous awards as a premier university ridesharing program in the U.S. While vanpooling has become the focus of the CAR program, the variety of services and promoted alternatives includes:

Vanpools

65 UCLA vans are currently serving Westwood and the campus, primarily with 15-passenger deluxe vans and some 6-passenger mini-vans. Seventy percent of the riders are staff, 20% students and 10% faculty and non-UCLA commuters. The vans are owned and maintained by UCLA. The round trip distances that vans travel range from 25 to 200 miles. Fares are based on mileage and average $60-120 per month for full-time riders. Use is also allowed on an occasional, space-available basis. Demand is growing for vanpools and the use of starter vans is an attempt to capture the latent demand for vanpooling without waiting for enough passengers to make a 15-person van viable. Vanpoolers seem to rideshare for the convenience and reduced stress rather than for cost savings. Since the average vanpool fare is twice the parking fees and parking is available to employees, convenience must be the central draw.

Carpools

The CAR program maintains a service contract with Commuter Computer for Remote On-Line Access (ROLA) to the regional ridesharing database. This allows for on-line matching of interested individuals with others in the system. Interested individuals can also

fill out registration forms and receive matchlists in the mail. As mentioned above, three or more students are eligible for a Special Student Carpool Parking Permit which entitles groups to reduced rates and a priority on parking waiting lists. No preferential parking is provided for carpooling employees, since most get parking near their buildings. Recently, however, carpool permits have been instituted which offer a cost savings for three or more employees per vehicle.

Buspools and Transit Services

UCLA operates two commuter bus routes, from the Westchester/LAX area south of Westwood and from Sherman Oaks/Studio City north of campus. Hourly service (three runs) during the peak morning and afternoon periods is provided. The routes were determined by identifying employee/student concentrations that were approximately 8-15 miles from campus and thus not well served by vanpools. They serve existing Caltrans park-and-ride lots and one lot arranged with a private party. The fare is $1.50 each way or $55 for a monthly pass. The runs are currently operating at 50% load factors. UCLA contracts for the service with a private provider. The CAR Office also promotes the services of the three public transit systems and Caltrans park-and-ride lots that serve UCLA.

Motorcycles, Mopeds, and Bicycles

There are 43 parking areas offering 2,300 spaces for motorcycles and mopeds. In addition, 57 areas on campus provide over 2,300 bicycle parking spaces. Given the significant number of students and staff that commute to UCLA and travel within the campus by bicycle, motorcycle and moped, the CAR program has developed an aggressive educational campaign on parking, safety and use of these modes.

Shuttle Service

A broad range of UCLA-operated shuttle services are provided: the Campus Express services, shuttles to off-campus housing areas, an Evening Van service linking housing areas to other key locations, and the Medical Center shuttle. The first three services are operated by Campus Transit and the fourth by the Hospital Transportation Department. The Campus Express utilizes 30 passenger vehicles and provides internal circulator service with the campus and to Westwood Village. It is free and well utilized by students and employees alike. It operates on 5-10 minute headways, serving ten stops through the campus.

Additionally, Campus Transit operates three park-and-ride shuttles to remote lots near the southwest corner of campus. The City's DOT operates a weekend shuttle services from a nearby Federal Building into Westwood Village (which is closed to traffic on weekends).

3. OVERALL EFFECTIVENESS OF PROGRAM

In order to assess the effectiveness of UCLA's evolving commuter assistance program, several data sources are utilized. Since 1970, UCLA has been performing periodic surveys, either Housing and Transportation or special Commuter Surveys. These surveys have been performed approximately every five years (1970-1985), plus a special evaluation was performed in 1988 among faculty and staff. These data, excluding students (see figure below), show the dramatic impact that the vanpool program emphasis has had since 1984. However, they also show the relatively stable relationship of drive alone commuters to users of alternative modes.

Mode Split 1970-1988 for UCLA Staff and Faculty

(Excludes Students)

Year	**1970**	**1975**	**1980**	**1985**	**1988**
Travel Mode					
Drive Alone	76.1%	74.4%	75.0%	75.6%	74.4%
Carpool	11.0	9.7	6.9	11.5	10.1
Vanpool	0.0	0.0	0.1	1.7	5.0
Transit	6.5	9.2	11.4	6.1	6.2
Other *	6.3	6.7	6.6	4.0	3.8
Vehicle Trips per 100 Employees**	80.7	78.6	78.2	86.7	79.0

* includes walking, bicycling, etc.

** Calculation assumes 2.5 persons per vanpool,
12 persons per vanpool trip, and
30 persons per transit trip

A shift of employees, from carpooling to transit, occurred right after two major gas crises (1975 and 1980) and the resurgence back to carpools was probably due to UCLA's rideshare marketing efforts and to a perceived denigration of bus service throughout the region.

Overall, the program seems to have attracted vanpool riders, and solidified carpoolers, but at the expense of transit and walk/cycle modes. Thus, between 1980 and 1985, while the proportion of transit users and carpoolers seems to switch and considerable movement occurred between several alternative modes, traffic volumes increased by 17% and the drive alone rate remained the same. It should be mentioned that the survey and methodology between the two periods was somewhat different; the survey is based on sample, while the traffic volumes are from direct observation. The 1970-80 surveys were performed to gather transportation and housing information. A more detailed survey on transportation behavior and attitudes was used in 1985 with a smaller sample size.

Assessing the overall effectiveness of UCLA's TDm program can be performed by utilizing the method of calculating vehicle trip generation as employed throughout this report (described in table above). Based on this calculation, it can be shown that in 1980, before the TDM program was initiated in earnest, UCLA was generating 10,951 daily vehicle trips from among its approximately 14,000 employees. This translates to 78.2 trips per 100 employees. In 1985, after initiation of the program and its vanpool component, the rate increased to 86.7 trips per 100, translating to 13,867 vehicle trips from a population of then 16,000 employees. The rise in vehicle trip generation was primarily due to a 5% shift away from transit to carpooling (and only 1.7% vanpooling). However, in 1988, when the vanpool program was accounting for a full 5%, 14,231 vehicle trips were generated, translating to 79 trips per 100. There fore, the vanpool program was able to recapture the trip reduction gains that were lost in the general shift from transit.

In any case, there seems to be a stable level of drive alone commuting (about 75%) and considerable movement between alternative modes, although almost 30% of the carpoolers polled in 1988 have been carpooling to UCLA for five years or more. Seven-tenths carpool with household members, indicative of the size and variety of employment on campus. Additionally, 70% of carpoolers share a parking permit, which had a clear benefit to UCLA's already strained parking situation. However, since all employees have access to parking, priced below market rates, the primary motivation among staff and faculty seems to be the convenience of commuting with others and not having to deal with traffic congestion on a daily basis.

Commute patterns are clearly influenced by the distance to work. An interesting analysis is provided through the 1985 survey results, by comparing the average commute distance, duration and speed for each travel mode, as shown in the following table:

Commute Mode	Distance	Time	Speed
Walk/Bicycle	2.5 miles	22.2 min	7 mph
Bus	7.7 miles	41.0 min	11 mph
Motorcycle/Moped	10.0 miles	23.3 min	26 mph
Drive Alone	11.6 miles	31.4 min	22 mph
Carpool	15.3 miles	36.9 min	25 mph
Vanpool	29.4 miles	60.7 min	29 mph
All Employees	12.0 miles	30.8 min	23 mph

These findings confirm the conventional mode/distance relationships recognized in Transportation Demand Management (TDM) planning. Indeed, carpooling, vanpooling and transit serve different markets, partially differentiated by the distance to UCLA. Similarly, in 1988, 17% of the survey respondents who lived over 15 miles from UCLA traveled to work by vanpool, showing the effectiveness of UCLA's vanpooling program to penetrate this longer distance market.

4. OTHER PROGRAM EFFORTS

Another means to evaluate the effectiveness of the UCLA CAR program is to compare it to another major university in the area. Comparing the mode split for UCLA versus another university's program reveals something about the programs at and conditions around UCLA.

California State University, Northridge (CSUN) is one of the largest campuses in the CSU system and is the third largest university in L.A. County (after UCLA and Cal State University, Long Beach). CSUN is located in the San Fernando Valley in a lower density area than Westwood. Some 30,000 students attend CSUN and 4,500 faculty and staff work at the University. Parking is constrained at CSUN, with only 1,500 parking spaces available to employees (although a significant number of employees work during evening classes) and only 5,400 for students. Staff and students pay $12.00 per month for parking and faculty pay $7.50 per month. Unlike UCLA, CSUN's parking permit program is not capacity controlled -- in other words, anyone can purchase a permit but they are not guaranteed a space, as far more permits are sold than spaces are available.

Prior to the passage of the SCAQMD's trip reduction regulation, CSUN's commute management program consisted of a standard, somewhat passive approach. Annual ridesharing registration drives were conducted with Commuter Computer and transit information was provided at the Student Union. Additionally, facilities were installed for a

bus lane and terminal on campus as well as considerable provisions for bicycles. Based on 1988 (UCLA), 1989 (CSUN) survey data (and 1988 regional statistics) the mode split for University employees is as shown in the table below:

COMPARISON OF UNIVERSITY EMPLOYEE TRAVEL

	UCLA	CSUN	REGION
Travel Mode			
Drive Alone	74.4%	85.1%	83.0%
Carpool	10.1	6.6	14.0
Vanpool	5.0	0.1	1.0
Transit	6.2	0.6	2.0
Bicycle/Walk	3.4	6.6	0.0
Other	0.4	1.0	0.0
Vehicle Trips Per 100 Employees *	79.0	88.0	83.6

* Calculation assumes 2.5 persons per vanpool,
12 persons per vanpool trip, and
30 persons per transit trip

The sample for the CSUN sample was not a random sample, but given the self-selection bias among ridesharers, the sample probably does not severely underestimate non-drive alone. The increased walk/bicycle proportion is probably due to the existence of affordable housing within short distance of the campus at Northridge and the low transit patronage related to service levels and coverage. The statistics do, however, point to the ability of the UCLA program, acknowledging the more congested conditions and transit availability, to maintain 10% more employees using commute alternatives with their more comprehensive program. However, it should be noted that CSUN has a more constrained parking situation than UCLA, but its employees seem to respond by adjusting parking times and locations rather than switching modes.

It should be noted that since the passage of AQMD Regulation XV, CSUN and the entire CSU system is taking a hard look at the commute incentives that will need to be offered to affect the necessary trip reductions.

Comparing UCLA's program to that of CSUN and the region as a whole, on a trip reduction basis, permits an assessment of the effectiveness of the UCLA program in reducing vehicle trips. As mentioned above, in 1988 UCLA generated 79 vehicle trips per 100 employees. CSUN generates 3,961 vehicle trips among its 4,500 employees, for 88 trips per 100 employees. If UCLA were to generate trips at the same rate as CSUN, 15,844 vehicle trips would be made by its 18,000 employees. If CSUN is considered typical of university commutation conditions, then UCLA's program has reduced 1,613 trips over this ambient condition, for a 10% trip reduction over levels attainable with a typical programs. Comparing UCLA with CSUN yields a very positive profile for the trip reduction accomplishments of UCLA. However, comparing its results with he region as a whole is perhaps more realistic. If UCLA were to generate vehicle trips at the rate of the LA region, i.e., at the rate of 83.6 trips per 100 employees, its population would produce 15,048 vehicle trips. Based on this comparison, this means that the UCLA is reducing 812 vehicle trips from background levels, constituting a 5.4% trip reduction.

5. FUTURE PLANS FOR THE UCLA TDM PROGRAM

UCLA has a long term budgetary commitment to TDM. The current year budget is over two million dollars for all the commuter programs and services offered. UCLA is in the process of planning and implementing three new components to its program. In the spring of 1989, UCLA was the catalyst in forming a Transportation Management Association for the entire Westwood area. The university contributed $70,000, which was matched by city funds for the formation of the Westwood Transportation Network. UCLA's desire is to expand the CAR program to the entire activity center in order to have a greater impact on area traffic. CAR staff, in conjunction with an area chamber of commerce and several businesses, is currently setting up the TMA and establishing the TMA office.

Second, the CAR program has recently implemented a Guaranteed Ride Home program for ridesharers. Drive alone respondents to the 1988 survey cited such a back-up system as the primary incentive that might encourage them to carpool or vanpool.

Finally, parking rates at UCLA were increased as of July 1, 1989, from $22 per month to $30 per month. While students have been eligible for special carpool parking permits, this will be the first time that faculty and staff will be able to purchase a carpool permit. Thus, employee carpools of three or more can realize a cost savings by purchasing a single carpool permit for $22 rather than individual permits at $30. Finally, a "RIDE" card is available to ridesharers, offering the occasional driver a guarantee to park in their preferred lot for the old daily rate of $3.00. This increase in employee (and student) parking rates, and the availability of carpool permits and the RIDE card for occasional parking may create more of a financial incentive among employees, whereas heretofore, the main motivation seemed to be the convenience of sharing a ride and the potential for reducing commute stress.

10. CASE STUDY: ATLANTIC RICHFIELD COMPANY

DOWNTOWN LOS ANGELES, CALIFORNIA

1. SITE DESCRIPTION

Location and Character of Site

The Los Angeles Central Business District (CBD) is the largest employment center in the L.A region. An estimated 225,000 employees work in downtown L.A. This area is the banking, cultural, and government center of the region, and will likely remain so, due to L.A.'s position as a major international center in the Pacific Rim economy. Major banking reform in California, which will allow the entry of many new banks in 1991, is expected to bring considerably more new employment to downtown L.A. Over a quarter of a million employees are expected to work in the CBD by 1995.

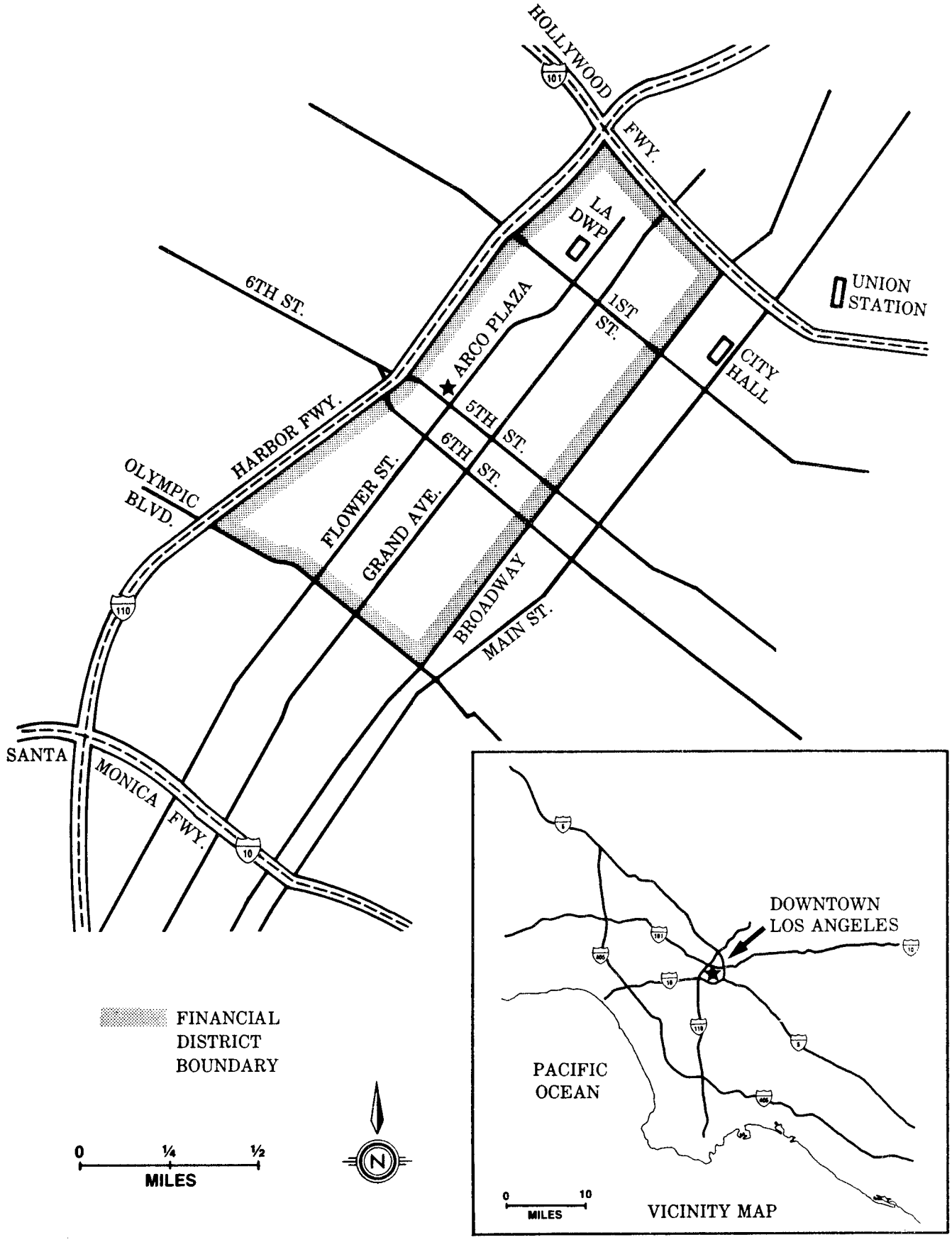
Of the 225,000 employees, 175,000 are classified as "office workers." Since the 1960's, over 23 million square feet of new office development and 5 million of retail/wholesaling space has been added to downtown L.A. As of 1987, the 20 largest (in terms of costs) office developments that were approved or under construction accounted for an additional 14.3 million square feet, including L.A.'s first 70 story building, Library Square.

Transportation Facilities

Much of the regional freeway system (see Figure 1) is radially-oriented, with downtown L.A. as the hub. The CBD is bounded by the Santa Monica Freeway (I-10) to the south, the Harbor Freeway (I-110) to the west, the Hollywood Freeway (U.S. 101) to the north and the Golden State (I-5). In fact, the Harbor Freeway becomes the Pasadena Freeway north of downtown and this was the first freeway in the U.S. when it was opened in the 1930's as the Arroyo Seco Parkway.

L.A.'s transit system is also radially-oriented, especially the peak hour express service. The Southern California Rapid Transit District (RTD) has 51 local and 43 express routes serving downtown L.A. Additionally, the City of L.A. DOT contracts for another eight commuter express routes and the County for four others. The Santa Monica, Montebello, and Torrance municipal systems operate express service to downtown L.A., as does the Orange County Transit District. In all, over 100 local and express routes serve downtown L.A.

Several transit facilities serve downtown L.A. or are in the process of being constructed. The El Monte Busway operates from the San Gabriel Valley to the east and utilizes a separated right-of-way to Union Station. The Busway is open to buses, vanpools, and carpools with three or more occupants. The El Monte Busway is in the median of the San Bernardino Freeway and signs along the route proclaim, "Busway users save 20 minutes during peak periods." Another commuter lane is currently being constructed on the Harbor Freeway, from San Pedro (the Port of L.A.) to downtown and will be operational in 1993.



DOWNTOWN LOS ANGELES, CA

FIGURE 1

The RTD is currently constructing the first operable segment of the Metro Rail Red Line, which will operate from Union Station to Alvarado Street (4.4 miles). Subterranean construction is ongoing and the line is planned to open in 1994. The Los Angeles County Transportation Commission is currently constructing the L.A. - Long Beach Light Rail Line (Blue Line) from downtown L.A. to downtown Long Beach. The Red and Blue lines will have two common transfer stations. The Blue Line is scheduled for operation in 1991.

Finally, Amtrak service to San Diego, Orange, and Ventura Counties operates as commuter rail service during the 4-5 peak hour runs. Caltrans subsidizes the peak hour service and many trains operate at standing-room-only. The City of L.A. operates a downtown shuttle service from Union Station throughout points downtown.

Traffic conditions in and around downtown L.A. are severely congested and getting worse. While 225,000 people work in downtown L.A., it is estimated that over 700,000 people enter the downtown on a typical workday. This quantity of trips, coupled with Metro Rail construction, has created severe congestion on both downtown streets and the freeways serving downtown L.A. Downtown streets often experience near gridlock conditions, prompting the City to enact a gridlock law, imposing stiff fines for getting "caught in the box."

Several solutions have been devised to address traffic congestion. The city, with its Automated Traffic Surveillance and Control (ATSAC) system, and Caltrans' downtown traffic control center are working to improve the efficiency of the roadway system, but it is clearly not enough. Los Angeles' mayor, with the support of the downtown business community and all major government agencies, has developed a transportation management plan that includes a heavy emphasis on Transportation Demand Management (TDM). To show the city's commitment, parking rates for city employees was raised from $5 per month to $25 and transit pass subsidies introduced. The City also passed a landmark ridesharing ordinance in 1986, requiring all employers with 500 or more employees and all buildings with 550,000 square feet or more to develop programs designed to increase peak period vehicle occupancy to 1.75 in the downtown and 1.5 in most other areas. This ordinance was repealed when the regional air quality trip reduction regulation was enacted. The Community Redevelopment Agency (CRA) of Los Angeles also has a comprehensive set of development requirements for trip reductions programs at new developments.

Commuting characteristics of downtown employees reveals a much higher use of alternatives than for the region. Forty percent of downtown L.A. office workers commute to work by means other than driving alone, according to a CRA ridesharing survey conducted in early 1987. The modal split of downtown office workers, as compared to regional statistics compiled by Commuter Computer, is:

	Downtown L.A. (1987)	Region (1988)
Travel Mode		
Drive Alone	60%	83%
Rideshare *	19	15
Transit **	21	2

* includes walk, bicycle, motorcycle, other
** includes commuter rail and private bus

According to the CRA survey, the downtown experiences severe p.m. peak hour peaking problems, as 28% of office workers leave between 4:30 - 5:00 p.m., as compared to 11% for workers throughout the region. In fact, 25% of downtown office workers leave in the 15 minute period, 4:30 - 4:45 p.m., while only eight percent leave in the 15-minute periods before and after this rush "quarter hour." Thus, the CRA study concluded that downtown L.A. possesses significant potential for flex-time, especially given the fact that only 38% of the employers surveyed offer some form of a flex-time programs.

Employer programs vary considerably, but the CRA survey showed that 83% of the employers responding provide free or highly subsidized parking. Only 14% of the private companies surveyed have commute management programs, and 19% retain Employee Transportation Coordinators. This is compared to 83% of the government agencies that offer some form of carpooling program for employees. While 21% of the downtown office employment uses transit to get to work, only 12% of the employers provide subsidized transit passes and four percent offer free transit passes to employees. Interestingly, among private firms, service, finance, insurance and real estate firms are the primary providers of transit incentives. This is likely due to the large proportion of administrative and clerical workers employed at these types of firms.

Therefore, traffic in and approaching downtown L.A. is severely congested and getting worse as the downtown economy flourishes and the transportation systems slowly expands. The proportion of employees using alternatives to driving alone is quite impressive when compared to the region, but this is largely due to the transit orientation of downtown L.A. The proportion of employees ridesharing to work is not significantly higher than the regional average. However, some downtown companies have proven to be exceptions to this, and the Atlantic Richfield Company's program is often touted as an exemplary program nationwide.

2. BACKGROUND AND MOTIVATION FOR TDM PROGRAM

This case study focuses on the TDM program at Atlantic Richfield's downtown Los Angeles site. ARCO's TDM program has been heralded as exemplary since its inception in the early 1970's. Located in the Bunker Hill area of downtown L.A., ARCO Plaza has twin 52-story towers and a retail complex. ARCO's international headquarters were relocated here from New York in 1972, and ARCO has maintained from 3,000 to 1,500 employees at this and nearby sites since that time. The buildings, located on the block bounded by Figueroa, Flower, Fifth and Sixth Streets, are multi-tenant structure with many large and small employers.

At the time that ARCO relocated its headquarters from New York City to Los Angeles in 1972, the firm began a carpooling and subscription bus service. The latter consisted of leasing six buses from the RTD to provide service for employees located in the San Fernando and San Gabriel Valleys to its downtown L.A. office. This commuter assistance program soon evolved into a vanpool program, and ARCO was instrumental in forming one of the first regional ridesharing organizations, Commuter Computer (a.k.a. Commuter Transportation Services, Inc).

ARCO currently has some 700 employees in ARCO Plaza and another 700 employees in the Trans-Pacific Building across the Harbor Freeway. ARCO leases 350 spaces within ARCO Plaza for employee parking, and 300 spaces within the Trans-Pacific Building. While the building allocate slightly more parking spaces based on ARCO's office space leases, their TDM program results in parking demand that is equal to or less than half of the employees in each location. The parking spaces are not included in the floor space leases, so ARCO is faced with leasing spaces at $135 for ARCO Plaza and $125 at the Trans-Pacific Building. The firm passes part of these costs on to employees. Therefore, while ARCO has access to a larger number of spaces in each building, their TDM program and parking subsidy scheme (each described below) has resulted in the firm needing only one space for each two employees. However, ARCO cites the primary motivation for establishing and maintaining the program as contributing toward traffic congestion relief and energy conservation efforts.

Currently, ARCO's transportation management program consists of seven primary alternatives to driving alone, including:

(1) Carpooling

(2) Company Sponsored Vanpooling

(3) Buspooling

(4) Transit Information and Pass Sales

(5) Amtrak Commuter Rail

(6) Telecommuting (working from home)

(7) Compressed Work Weeks

ARCO also encourages walking and bicycling to work, but its location makes these alternatives relatively infeasible. Commute data for all employees is maintained on a computer by the commute management office, staffed by three persons. The manager of that program also serves as a loaned executive to the Central City Association of Los Angeles, in its efforts to form a set of Transportation Management Associations in downtown.

ARCO's vanpool program is at the center of its commute management effort. ARCO leases the vans and in turn charges users an average of $60 per month in fares. The company pays the insurance and allows employees of other firms to ride in its vans. ARCO currently has 55 vans operating and leases the vehicles for five years, assuring that modern, well maintained vans are always in use. ARCO also backs up its ridesharing program with a guaranteed ride home service, utilizing a near-by car rental company. Riders that have important meetings during the day or have an emergency at home can rent a car at a substantially reduced rate.

ARCO's rideshare subsidy program is comprehensive and also allows for the tracking of all ARCO employees' commute habits. Basically, ARCO provides a graduated scale of parking subsidies for employees, depending on auto occupancy and offers all ridesharers and transit users a $15 per month Transportation Allowance (the maximum currently allowed by federal tax law as non-taxable). The subsidy program is effected through the employee payroll program and the employee share is deducted on a monthly basis. The features of the subsidy program as they apply to each travel mode are:

Drive Alone:	ARCO pays one-third of the $125-135 monthly parking fee for each building
2-Person Carpool:	ARCO pays two-thirds of the parking fee for each two-person carpool parking space, plus provides each user a $15 transportation allowance
3-Person Carpools:	ARCO provides a free parking space to carpools of three or more employees, plus provides each user a $15 transportation allowance
Vanpoolers:	Each vanpooler is given a $10 per month parking subsidy (assuming 12-13 in a van would pay for a space), plus provides each user a $15 transportation allowance
Bus, Train and Buspool:	Each transit user is given a $15 transportation allowance

Thus, the per-person subsidy cost to the firm ranges from a low of $15 per month for transit users to $58 per month for two-person carpoolers.

3. OVERALL EFFECTIVENESS OF PROGRAM

ARCO prides itself on having maintained at least a 50% alternative mode split since 1973, even though its workforce size has fluctuated and several external forces, such as gasoline price and transit service changes have occurred. In 1984, a company reorganization reduced the number of employees from approximately 3,000 to 2,000 and in 1988, the relocation of the International Company to Texas further reduced the workforce to around 1,500. The mode split for ARCO for three representative years is indicated in the following table:

	1983	**1986**	**1989**
Travel Mode			
Drive Alone	34.4%	45.3%	40.0%
Carpool	22.4	20.2	26.2
Vanpool	12.8	14.3	13.6
Transit/Amtrak	30.4	20.2	20.2
Veh. Trips per 100 Employees *	44.5	55.3	45.6
Vehicle Occupancy	2.25	1.81	2.19
Employees	3,000	2,000	1,500

* Assumes 2.5 persons per carpool
12 persons per vanpool, and
30 persons per transit trip

Thus, while the drive alone rate and vanpooling rate have hovered around 40% and 13%, respectively, ARCO has compensated for decreasing transit usage by strengthening its carpool program. This mode split, with an overall occupancy rate of 1.81, has enabled ARCO to report an a.m. vehicle occupancy rate of 1.96 to the South Coast Air Quality

Management District in response to Regulation XV, which requires all large downtown employers to meet an occupancy target of 1.75. ARCO's vehicle occupancy rate is much higher than the reported regional occupancy rate of 1.13.

The firm reports several perceived benefits from its ridesharing program. First, ARCO feels it is contributing to finding solutions to downtown traffic congestion and regional air quality problems. Its on-going commitment since 1973 to its own program and to regional ridesharing efforts is testimony to this. Second, the firm has reduced its parking needs through the program. As noted above, the TDM program and its transportation subsidy system have contributed to decreasing parking demand to one space for every two employees. Third, employee attendance, morale and productivity are all reported as improving.

4. INDIVIDUAL PROGRAM EFFORTS

Another means to evaluate the relative effectiveness of the ARCO program is to compare it to other large employer programs in downtown L.A. and to areawide statistics.

Bank of America

Bank of America was selected as a comparison site in the downtown to help gauge the effectiveness of ARCO's TDM program. Bank of America (B of A) occupies much of the other twin tower in ARCO Plaza.

In 1986, a UCLA graduate student performed a comparison of the ARCO program to that of B of A. While the samples from the surveys used in this analysis were quite small, the comparison was interesting in its discussion of mode choice.

In 1986, B of A had 2,045 employees and ARCO had a similar amount. At the time, B of A had no organized ridesharing program nor did the firm subsidize any alternative commute mode. It did subsidize 40% of the $100 monthly parking fee (at that time) for ARCO Plaza. It allocated 508 spaces, of a total of 800 available spaces (allocated by its floor lease, as with ARCO) for employees. There was a six month waiting list for subsidized spaces. For those without a subsidized space, their choice was to pay the full cost of a parking space, find a cheaper lot away from Bunker Hill, carpool and share the costs, or use transit.

As seen in the following table and based on the survey data, the mode choice comparison reveals that B of A experienced the same drive alone rate as ARCO, but more employees used transit at B of A, while more ARCO employees used carpools and vanpools.

COMPARATIVE MODAL SPLIT

BANK OF AMERICA VS. ARCO

	B of A	ARCO
Travel Mode		
Drive Alone	49%	48%
Carpool/ Vanpool	20	34
Transit	31	18

B of A's parking policy served to constrain parking on-site for employees and prompt a large proportion of employees to seek alternative commute modes. However, in the absence of a comprehensive TDM program with a range of alternatives, many B of A employees used the transit system. On the other hand, ARCO's vanpool program, carpool promotion, and balanced subsidy program induced more commuters into shared ride modes. These data illustrate that the particular incentives in a company's TDM program can dramatically affect its employees' travel choices.

Department of Water and Power

The Los Angeles Department of Water and Power (DWP) is another large downtown employer (3,850), with a General Office Building site four blocks north of ARCO Plaza. The building is a 17 stories high and contains 600,000 square feet of office space. DWP maintains a Commuter Services Office with a staff of six, plus part-time coordinators at other DWP sites.

The parking situation at DPW is fairly constrained, with only half of the employee capacity located on site. Employee parking is located in a garage under the building, in three levels totaling 1,995 spaces. This is approximately three spaces per 1,000 square feet of office space, or one space for each two employees in the building. Assigned parking spaces are allocated to employees on a seniority basis at $30 per month. Scramble parking (parking wherever an open space exists) is offered for $10 per month. Because the parking supply in the building is always at capacity, additional parking is provided across the street at the

To encourage ridesharing and reduce parking demand, DWP has a graduated parking fee structure for ridesharers, with carpools paying $12 per month and vanpools receiving free parking. Preferential parking for carpools and vanpools is made available in the General Office Building near entrances from the garage to the office building. DPW's ability to reduce parking demand clearly helps it minimize costly dependence on off-site parking leases.

While DWP does not offer a travel allowance, such as ARCO, it does have an aggressive program to market commute alternatives, particularly vanpools. Since December 1986, DWP has established 49 vanpools with waiting lists for more vans. More vans have been ordered, and the total demand for vanpooling is estimated at 77 vans. In fact, the proportion of employees commuting by vanpool has increased from 0.5% in 1986 to 10.2% in 1988. One reason that vanpooling is so successful is that 42% of DWP employees live 20 miles or more from work, as compared to about 25% for ARCO and B of A. Even with these distances, only five percent of DWP employees use transit, which is surprising as compared to the downtown as a whole and since most employees pay from $30-70 per month for parking.

Comparing the mode split of three large employer programs (ARCO, B of A, LADWP), downtown office workers (as surveyed by the CRA), and the region as a whole (as surveyed by Commuter Computer), the effectiveness of these large employer programs is clear from the presentation in Table 1.

Comparing the effectiveness of ARCO's TDM program in reducing vehicle trips, the number of vehicle trips per 100 employees was calculated using the occupancy factors utilized throughout this report. For those programs without separate carpool and vanpool proportions reported (Bank of America), the carpooler rate of 2.5 persons per vehicle was used. This is probably accurate in that B of A has no formal vanpool program and any vanpoolers would be commuting in private vans or those supported by other employers. ARCO generated 1105 vehicle trips for its 2,000 employees in 1986. This trip rate of 55.3 trips per 100 employees is almost three trips per 100 less than Bank of America (even with its high transit usage), 13 trips per 100 less than the Department of Water and Power and the CBD office employment, and 28 trips per 100 less than the regional mode split would dictate (due to the use of transit).

If B of A were seen as a typical employer and ARCO were to generate trips at the same rate as B of A, it would produce 1,148 trips or 42 more than with its existing program, for a four percent trip reduction attributable to the program. Alternatively, if the Department of Water and Power's program, with low transit use, were used as a control, ARCO would generate 1,360 trips among its 2,000 employees, or 255 more trips than with its comprehensive program, for a 19 percent trip reduction attributable to the program. Similarly, if ARCO were to generate trips using the CBD statistics a the norm or background conditions, 1,366 trips would be generated among the 2,000 workers in 1986, or 261 more vehicle trips than generated as a result of ARCO's TDM program, or a 19% trip reduction over ambient conditions.

Much of the success of ARCO's program is due to the large employee base from which to match ridesharers, the strategic use of parking supply and pricing, the overall subsidy scheme, and good downtown transit service. Their program stands out for their ability to induce half of the employees working at the downtown sites to commute to work by means other than driving alone over a 15 year period.

TABLE 1

COMPARATIVE TRAVEL CHARACTERISTICS

FOR SELECTED DOWNTOWN L.A. EMPLOYERS

	ARCO (1986)	B of A (1986)	LADWP (1988)	CBD (1987)	REGION (1988)
Travel Mode					
Drive Alone	46%	49%	55%	60%	83%
Rideshare	34	20	40	19	15
Carpool	(20)	NA	(30)	NA	NA
Vanpool	(14)	NA	(10)	NA	NA
Transit	20	31	5	21	2
Vehicle Trips Per 100 Employees *	55.3	58.0	68.0	68.3	83.6
Vehicle Occupancy	1.81	1.74	1.47	1.46	1.19

* Assumes 2.5 persons per carpool,
12 persons per vanpool, and
30 persons per transit trip

11. CASE STUDY: SOUTH COAST METRO

ORANGE COUNTY, CALIFORNIA

1. SITE DESCRIPTION

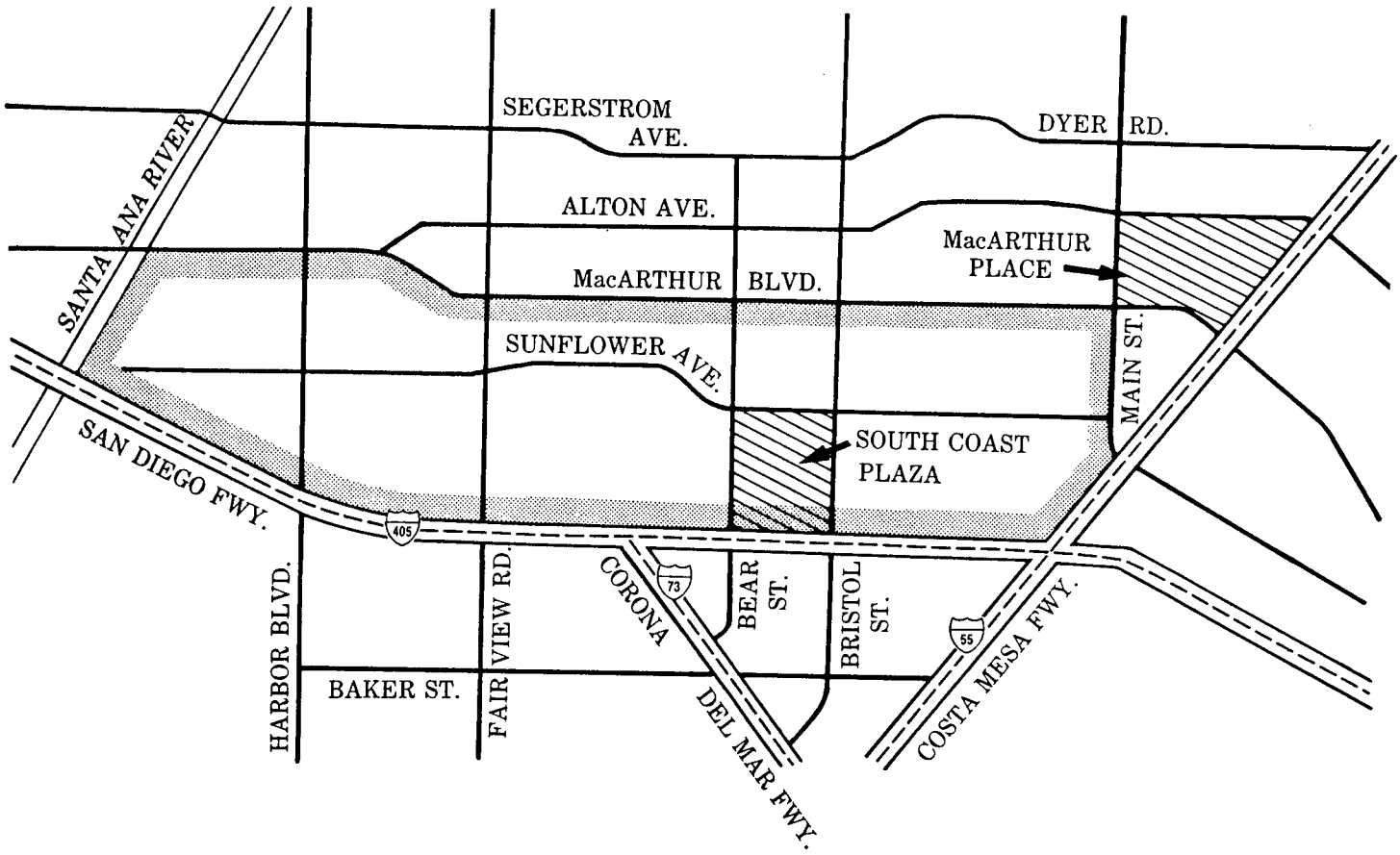
Location and Character of Site

Orange County, located between Los Angeles and San Diego Counties, is the epitome of the multi-centered suburban area (see Figure 1). Orange County remains one of fastest growing counties in the nation (ranked third in rate of growth according to the 1980 census), and is no longer a set of "bedroom" communities for Los Angeles. The county has just over two million residents and almost one million are employed in the county.

While Santa Ana is the county government center and possesses a downtown core, the largest employment concentration in Orange County is in the vicinity of John Wayne Orange County Airport. Comprised of the Irvine Spectrum, the Irvine Business Complex and South Coast Metro, these activity centers are all situated within the Orange County Airport Area. These centers comprise 24 million of the county's 37 million square feet of existing speculative office space. Employment in the Airport Area is approximately 200,000, which is of a scale similar to downtown Los Angeles and San Francisco. Unlike these downtowns, however, the Orange County Airport Area does not possess a rapid transit system or a radially-oriented highway system. Dispersed residential and employment patterns place a tremendous strain on the transportation system. Congestion levels on Orange County freeways are approaching some of the worst experienced anywhere in the U.S. Given the expected growth in employment and development anticipated for this area, the situation is likely to get worse before it gets better.

South Coast Metro is a mixed-use activity center, comprised of over 2,200 acres, and is situated in portions of the Cities of Costa Mesa and Santa Ana (see Figure 1). The "official" boundaries for South Coast Metro differ somewhat, but figure 1 presents the general area. At the heart of the center is South Coast Plaza, which includes one of the nation's largest retail centers, the Orange County Performing Arts Center, major hotels, a residential complex, and several high-rise office buildings. With several other developments in the area in existence or planned, South Coast Metro is considered by many as Orange County's "downtown." Existing (1987) land uses for the center as a whole include over 6.5 million square feet total of office, and R&D uses. The center has over 3.5 million square feet of retail space and almost 2,000 hotel rooms. Over 5,500 housing units are situated in South Coast Metro, ranging in type and density. Over 25,000 employees work for some 1,100 firms within South Coast Metro. While several large employers exist, most employees work for smaller retail, insurance, banking, and law firms.

At build-out, South Coast Metro is estimated to possess 13.5 million square feet of office space and employ 45,000 persons. Another major project, MacArthur Place will have a significant impact on the area. The parcel is located on the southeastern edge of South Coast Metro and is planned to include 3.8 million square feet of office space and 300 residential units. Over 15,000 workers may ultimately be employed at MacArthur Place.



SOUTH COAST METRO BOUNDARY

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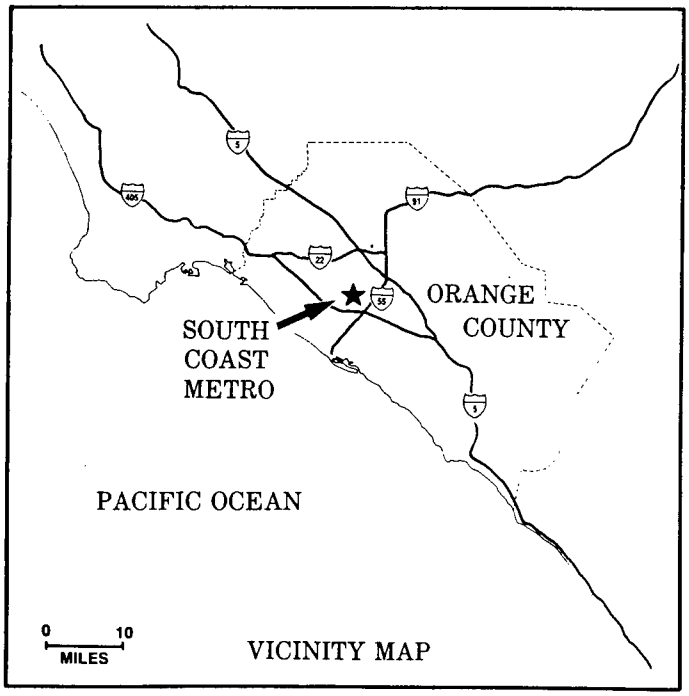

SOUTH COAST METRO — ORANGE CO., CA

FIGURE 1

Transportation Facilities

As of the summer of 1989, each of two major freeways serving South Coast Metro, the San Diego (I-405) and Newport/Costa Mesa (SR 55), will possess high occupancy vehicle lanes for carpools, vanpools and buses. The other freeway serving the area is the Corona Del Mar freeway (SR 73). There are HOV by-pass lanes on most freeway on-ramps. The Orange County Transit District serves the center, and as a major shopping and employment center, service is relatively good.

Circulation within the center is also quite good, with wide arterials serving South Coast Metro. The problem seems to be of a more regional nature, as chronic congestion on the freeways backs-up onto the arterials during the peak periods. As of 1980, adjacent freeways were operating at about 85% of capacity. It is estimated that by the year 2000, the freeways will be operating at 135% of capacity. The County estimates that daily trip-making will increase by 59% by the year 2000, from 410,000 daily trips to the two cities to 667,000 trips.

2. BACKGROUND AND MOTIVATION FOR TDM PROGRAM

Several factors were responsible for developing a transportation demand management program in South Coast Metro. Each is briefly discussed below:

First, the South Coast Metro Alliance, a developer consortium, promotes Transportation Demand Management as an amenity for tenants, owners and users in its marketing of the center. This brought key commitments from the development community for a transportation management program.

Second, the local land use and transportation policies of the two cities, Costa Mesa and Santa Ana, have set the stage for traffic mitigation. Several key local and regional policies have affected the development of South Coast Metro and it's transportation management program. South Coast Metro was planned as a high-density, mixed-use development. Shared parking arrangements were included to reduce the overall parking supply by shared use of office and retail/entertainment uses. The tremendous growth of the center, however, has placed some strain, albeit in limited cases, on the parking situation in the center and this has contributed to the need for a center-wide TDM program. TDM is viewed as reducing further parking problems in the future as development continues.

The City of Costa Mesa, in addition to its shared parking ordinance, has an innovative housing ordinance, placing requirements on large developments, like South Coast Metro. This ordinance requires housing, either on-site or within city limits, to serve at least 20% of the project's workforce. This has prompted South Coast Metro developers to build over 1,200 multifamily units within the boundaries of the center. A 1981 Costa Mesa ordinance does require developers of South Coast Metro to implement TSM programs prior to issuance of building permits and submit a status report prior to occupancy. However, this statute has not been enforced to date as city staff feel it difficult to monitor such programs after occupancy.

The City of Santa Ana does not have mandatory TDM requirements as part of an ordinance, but is becoming more aggressive in requiring trip reduction measures as part of the development approval process. For example, at build-out, MacArthur Place is required to reduce trips by 30% which will be accomplished through a three-phase TDM program designed to result in 24% of employees commuting to the site traveling by alternative modes.

Third, a survey of employers and employees confirmed that a market existed for commute alternatives and that the formation of a Transportation Management Association was the appropriate means to implement a commute alternatives program. According to the 1986 employee and employer survey conducted in South Coast Metro (see below for more information), 44% of employees felt that local streets were always or usually congested and 63% felt the freeways were similarly congested. Almost two-thirds of employers in South Coast Metro felt that traffic congestion was going to get much worse and that congestion was affecting the delivery of products, employee tardiness and accessibility for clients and customers. Over 90% of these employers agreed that it was in their best interest to get directly involved in reducing traffic congestion.

Finally, a landmark trip reduction ordinance, passed by the regional air quality agency has involved many more employers in the transportation management program. This major regional air quality regulation is providing an additional impetus to TDM programs, above and beyond the need created by the worsening traffic and parking situation. In December 1987 the South Coast Air Quality Management District (AQMD) adopted Regulation XV, the nation's first mandatory trip reduction regulation tied to air quality attainment. While encompassing a four-county area in southern California, Regulation XV will impact all employers with 100 or more employees at any site. This will impact over 1,000 sites in Orange County. These employers are required to develop and implement a trip reduction plan, within 12 months, to achieve an average vehicle occupancy of 1.5 during the morning peak period. The regional auto occupancy is currently about 1.13.

Upon notification, the employers have 90 days to submit a plan, have a designated transportation coordinator trained, and file an application fee. A calculation of baseline vehicle occupancy, termed Average Vehicle Ridership (AVR), is required in the plan along with a listing of the incentives that will be offered to employees to reach the target AVR. Fines of $25,000 per day or incarceration can be levied against employers for not submitting a plan or not offering the incentives promised within the plan, but not for failing to meet the specified trip reduction targets. Regulation XV has provided an increasing demand for the program at South Coast Metro as more employers are notified to comply.

Components of South Coast Metro's TDM Program

Development of a transportation management program for South Coast Metro began as part of the efforts of the Orange County Transit District's Commuter Network. This county-wide commute management organization was reorienting its service policy to better serve major activity centers, rather than solely concentrate on individual commuters and employers. The Commuter Network had been working with Newport Center and the Irvine Spectrum for a year or more.

In 1986, the Commuter Network conducted a Mobility Enhancement Study in South Coast Metro. The purpose of the study was to explore the feasibility of initiating demand management strategies within the center and to determine the appropriate means for implementing these strategies. Supported by the South Coast Metro Alliance (primarily developers) and the Executive Task Force (representing over 80% of the center's major employers), the study involved a survey of commuters, employers, and interviews with chief executive officers. Some 2,600 commuters returned surveys and 144 employer surveys were returned.

The surveys revealed that the mode split for South Coast Metro was typical for the county in that the vast majority of commuters drive alone to work. A comparison of mode split from the 1986 South Coast Metro survey versus a 1988 county-wide survey reveals similar statistics:

	South Coast Metro	Orange County
Travel Mode		
Drive Alone	89%	90%
Carpool	8%	6%
Vanpool	1%	0%
Bus	1%	1%
Motorcycle	<1%	1%
Bicycle/Walk	1%	2%

Some of the reasons cited for driving alone included the fact that 93% of employees receive free parking at their workplace; 90% of all respondents need their car to run errands after work; and 71% would have difficulty in ridesharing with non-coworkers because their schedule is inflexible.

South Coast Metro does not experience severe peaking problems, at least not as compared with the neighboring Irvine Business Complex (IBC). Sixty-five percent of South Coast Metro employees arrive between 7:00 - 9:00 a.m., as compared to 90% of IBC employees. Only 49% arrive between the single peak hour (7:30 - 8:30 a.m.) as compared to 75% at the IBC. This is more in line with the mixed office/retail nature of South Coast Metro. Only 67% of South Coast Metro workers depart between 4:00 - 6:00 p.m., as compared to 86% at the IBC. Sixty percent of IBC employees leave work between 4:30 - 5:00 p.m., whereas only 38% of South Coast Metro employees leave during this half-hour period.

While this seems rather ominous for demand management prospects, some 57% of respondents said they would consider using an alternative 2 days a week. Additionally, three-quarters of the respondents said they would change their work schedule if given an opportunity.

The employer survey portion of the Mobility Enhancement study revealed that a joint public/private effort was needed as the most appropriate mechanism for organizing a transportation management program for South Coast Metro. In response, OCTD coordinated an effort to form the South Coast Metro Transportation Management Association. The TMA was formed in early 1988 as a cooperative effort of the South Coast Metro Alliance, the Employer Task Force, OCTD and the two cities. These groups are currently bound to the TMA effort through a memorandum of understanding. For the first year, the Alliance and OCTD are each contributing $85,000 toward the TMA. The TMA is staffed by a full-time executive director, a planner and an assistant.

The overall goals of the program are to:

- o create a self-sufficient TMA office
- o increase awareness of commute alternatives
- o implement TDM programs at employment sites
- o coordinate these programs to achieve maximum impact on reducing traffic congestion

In addition to providing centralized commute management services, such as carpool matching, vanpool formation, promotion of alternative work hour and telecommuting programs, and provision of tailored marketing materials and events, the South Coast Metro TMA provides the following services:

- o Employee Transportation Coordinator training
- o development of parking management programs
- o assistance in employer preparation of AQMD Regulation XV plans, via data collection, analysis and incentive planning
- o development and promotion of two transit routes for South Coast Metro bound commuters

3. OVERALL EFFECTIVENESS OF PROGRAM

The TMA has just completed its first full year of operation. No resurveying of employees has taken place nor a formal evaluation conducted. Therefore, no data exists to perform a mode shift or trip reduction analysis. The next section, on individual employer programs, does provide some insights into the effectiveness of selected programs and the potential

impact of the air quality trip reduction requirements. However, some preliminary results have been reported by the TMA in terms of achievement of internal objectives.

First, the TMA had a first year objective of increasing the number of South Coast Metro employees in OCTD's database by 7,200 individuals. Over 6,000 names have been added in the first year, which improves the ability of the TMA to match commuters from different firms into ridesharing arrangements. An objective was set to increase the number of OCTD-assisted ridesharers from approximately 375 to 1,500 and the TMA has identified some 416 new ridesharers since formation of the TMA. Additional objectives were set for transit ridership, use of flex-time and new worksite program, but insufficient information precludes any conclusions at this point.

While it is unclear what type of changes in commuter behavior would have occurred in the absence of the South Coast Metro TMA or the impact that the reported results have had on traffic congestion, the TMA has been able to increase the number of employers with TDM programs via a centralized transportation management program located within the center and in response to the air quality regulation.

4. INDIVIDUAL PROGRAM EFFORTS

To understand the types of individual employer programs that have been developed within South Coast Metro and the impact of Regulation XV, two programs are compared below. One program, at State Farm Insurance, exhibits a more effective trip reduction program than most firms in the area and the second, at Company "B" provides comparative statistics on a more typical effort.

State Farm Insurance

Approximately 980 people are employed by State Farm at its Southern California Regional Office in Costa Mesa. The company's TDM program before being subjected to the requirements of Regulation XV was primarily a passive ridesharing program. Prior to the spring of 1989, State Farm operated one vanpool, and encouraged employee ridesharing through preferential parking spaces, free morning coffee, and marketing through posters, memos and brochures. The company's rate of carpoooling was 20% in 1988, and its average vehicle occupancy rate was 1.22.

In order to comply with Regulation XV and increase its average vehicle occupancy to 1.5, State farm increased its TDM program efforts beginning in April 1989. The major change to its program was the introduction of a direct subsidy for those employees using commute alternatives. The subsidies are paid daily through use of a coupon system. Upon arriving at the company's parking lot between 6:15 and 7:45 a.m., coupons are issued to each employee according to the following formula:

Mode	Coupon Value
2-person carpool	$0.50
3-person carpool	$1.00
4-person carpool	$1.50
Bicycle, bus, walk	$1.50

Employees retain the coupons until they complete their time sheets, at which time they attach the coupons to the forms for cash reimbursement. Maximum monthly reimbursement under the system is $30, depending on the mix of modes used by the employee over the course of the month. Flexibility is an important aspect of the system: as employees' daily travel needs change, and they use different modes, they are awarded the appropriate type of coupon and level of subsidy.

The offering of subsidized van service has also become an important part of State Farm's enhanced TDM program. Currently, the company has two vans that are both full, and another van is expected to be added this fall. State Farm subsidizes one third of the costs of these vans. The vans travel between 60 to 80 miles per day, for which the passengers are charged approximately $40.00 per month. The driver receives 100 miles of free travel a month, and does not pay to ride in the van.

The addition of these new program features has had an important effect on mode choice and vehicle occupancy. The program is monitored by counting the number of vehicles n the parking lot during the first week of each month. Monitoring started in March of 1989, just before the new program initiatives, and data are available for each month since implementation.

As shown in the Table 1, the new program initiatives had the effect of raising State Farm's carpooling rate from 20% to 31% in only 1 month. Simultaneously,the average vehicle occupancy rate was increased from 1.21 to 1.55, placing State Farm in compliance with Regulation XV.

The vehicle trip reduction implications of this shift in modal use means that, within in one month following implementation of its revised TDM program with a financial incentive, State Farm was able to reduce its vehicle trip generation rate from 82.4 daily one-way trips per employee to only 63.4, a 22% reduction. This means that 820 - 630 = 190 additional vehicle trips have been removed from the roads.

An even more impressive assessment of State Farm's trip reduction accomplishments is obtained by comparing them with some other standards that are more reflective of "background" conditions. These other standards include:

TABLE 1

STATE FARM BEFORE AND AFTER REVISED TDM PROGRAM

	March 1989	April 1989
Employees	995	980
Travel Mode		
Drive Alone	78%	66%
Carpool	20%	31%
Vanpool	1%	2%
Other	1%	1%
Vehicle Trips Per 100 Employees *	82.4	64.3
Employee Vehicle Trips	820	630
Average Vehicle Occupancy	1.21	1.55

* Assumes 2.5 persons per capool,
12 persons per vanpool, and
30 persons per transit trip

- A comparable "Company B";
- The entire South Coast Metro employment area; and
- Orange County as a commuting region.

The results of these comparisons are shown in Table 2. Compared to the most nearly comparable "company B", a firm of equivalent size and function also located in South Coast Metro, but without a TDM program, State Farm's vehicle trip generation rate is 28% less than Company B. Compared to South Coast Metro's complex level trip rate of 92.3 vehicle trips per 100 employees or Orange County's 92.4, State Farm may be credited with a 30.4% reduction.

TABLE 2

COMPARATIVE MODAL SPLIT RATES AND TRIP REDUCTIONS

SOUTH COAST METRO, STATE FARM AND SELECT CONTROL SITES

	South Coast Metro (1986)	Orange County (1988)	State Farm (1989)	Company "B" (1986)
Travel Mode				
Drive Alone	89%	90%	66%	86%
Carpool	8%	6%	31%	8%
Vanpool	1%	0%	2%	0%
Bus	1%	1%	0%	2%
Motorcycle	<1%	1%	0%	4%
Bicycle/Walk	1%	2%	1%	0%
Vehicle Trips Per 100 Employees *	92.3	92.4	64.3	89.3

* Assumes 2.5 persons per carpool,
12 persons per vanpool, and
30 persons per transit trip

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TECHNOLOGY SHARING

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